**Malaysian Journal of Social Sciences and Humanities (MJSSH) (e-ISSN : 2504-8562)**
**2022, Volume 7, Issue 11, e001844**
**DOI:** https://doi.org/10.47405/mjssh.v7i11.1844

# Spatial Relationship between the Residential Land Price and the Land Intensive use in Hebei Province

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**KEYWORDS:**
Residential land price
Land Intensive use
Spatial relationship
Hebei province

**CITATION:**
Hong Ma & Oliver Valentine Eboy. (2022). Spatial Relationship between the Residential Land Price and the Land Intensive use in Hebei Province. *Malaysian Journal of Social Sciences and Humanities (MJSSH), 7*(11), e001844.
https://doi.org/10.47405/mjssh.v7i11.1844

**ABSTRACT**

Using the exploratory spatial data analysis method to analyze the level of residential land price, and calculate the use level of urban land intensive use based on the PSR model, exploring the differences between the urban residential land price and land intensive spatial in the city of Hebei Province in 2019 and make relevant suggestions. The result shows (1) The land price level of urban housing is characterized by spatial differentiation of circle structure with Langfang city as the center and decreasing outward. (2) The overall level of urban land intensive use shows the spatial differentiation characteristics of high in the southeast and low in the northwest. (3) The spatial distribution of urban residential land price level is different from that of land intensive use level, and there is a situation that the land price level is high and the urban land intensive use level is low. (4) Because of the shortcomings in the development of land price and intensive land use, some suggestions are put forward from the overall perspective of the whole province and the specific situation of each city.

**Contribution/Originality:** This study documents analyzes the land value and the intensive situation of land use, and puts forward relevant suggestions. This study contributes to enrich the research of intensive land use.

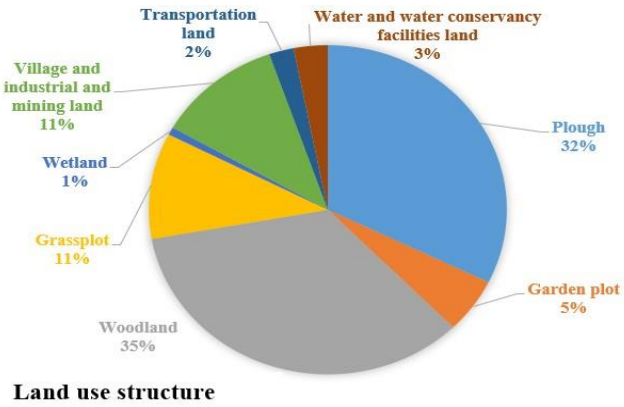
## 1. Introduction

Nowadays, with the rapid development of urbanization, the population growth rate of Hebei Province has reached its peak, the relationship between man and land is tense, and the urban land is in a state of continuous expansion. The available land resources in cities are increasingly scarce, the supply and demand of the land market are tight, the land price is also increasing rapidly, and the contradiction between people and land is becoming increasingly acute. Constructing "intensive and efficient production space" is the connotation requirement of high-quality development and urban construction in the new era (Hu & Zheng, 2019). Ideally, with the increase of land price, the level of intensive

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use of urban land will rise, land use efficiency will increase, and land benefits will also increase, which will drive the increase of land price and the optimization of land use structure, and finally form a virtuous development cycle. Whether the actual situation will develop along the ideal existing state is also the content that we need to know further. The current situation of land use in Hebei Province in 2019 is shown in Figure 1.

Figure 1: Land use structure map




Hebei province has a large proportion of agricultural land, the land used by villages accounts for less than one tenth of the total land, and the investment in urban public facilities is insufficient, so people's living area is tight and their living environment is poor. It is found that the intensive use level of urban land has not been improved correspondingly when the land price is increasing rapidly. In order to reduce the contradiction between man and land, reduce the pressure on land and improve the efficiency of land use, this paper plans to establish an index evaluation system of intensive land use under the present situation, and analyze and compare the residential land price and intensive land use in Hebei Province while analyzing the level of intensive land use. Find out the existing problems of intensive use of urban land in Hebei Province, and put forward suggestions and future development directions of intensive use of urban land in Hebei Province, so as to provide reference for sustainable economic development in Hebei Province. It also helps to improve the existing economic development mode, promote the optimization and upgrading of land use structure, and promote the sustained and healthy economic development of Hebei Province.

There have been many achievements in the research of urban land price and intensive land use (Promper et al., 2014; Yang et al., 2016). Xiong et al. (2018) using the system dynamics (SD), the feedback loop of urban construction land between supply and demand and function relationship between index variables are built up to simulate the change trends of the balance of land resources supply and demand in Changsha-Zhuzhou- Xiangtan urban agglomeration from 2016 to 2030 in three scenarios, in other words, low intensity mode, medium intensity mode and high intensity mode based on the land resources supply and demand system dynamic model. Through the setting of three development models, the change trends of different indicators in the three models are determined, which can provide scientific reference for land supply and demand decision optimization, urban construction planning and structural reform of land supply. Wei et al. (2017) took 12 development zones in Nanjing as the research object. He tried to use matter-element analysis and multi-factor comprehensive evaluation method to analyze the land intensive use level of development zones, and compared it with the evaluation results of land intensive use efficiency, in order to find a more suitable

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evaluation method of land intensive use. Wu et al. (2018) used AHP and multi-factor comprehensive evaluation method to carry out intensive use of urban construction land. After that, the intensive degree of the research area is obtained, and some suggestions are given for the evaluation results, so as to provide reference for the intensive use of urban construction land. The characteristics and methods of intensive land use evaluation in rural-urban fringe were discussed by Xie et al. (2013) through the analysis of intensive land use evaluation in Qixia District of Nanjing. Liao (2018) logically classified new industries or existing industries of intensive land use, and verified the correlation between industrial structures of STIRPAT, an environmental impact assessment model based on expandable randomness, according to the degree of intensive land use. Based on the measurement of land intensive use and urbanization level in Beijing-Tianjin-Hebei, Yangtze River Delta and Pearl River Delta from 2007 to 2013, Zhao and Hu (2016) used cointegration test, impulse response and variance decomposition to study the dynamic relationship and interaction strength between urbanization and land intensive use.

In the related literature about the research of Hebei Province, Zhao (2012) used the gravity model to study land price in Hebei Province. Fan et al. (2010) used the linear regression method to forecast the dynamic monitoring analysis and trend of land price in Hebei province. Su et al. (2013) studied the spatial distribution pattern of benchmark land price ratio of urban commercial land in Hebei Province. Ning et al. (2015) used GIS spatial analysis method and gravity center model to study the spatial and temporal differentiation characteristics of urban land intensive use in Hebei Province. Zhang et al. (2016) used data envelopment analysis (DEA) to study the spatial differences and influencing factors of cultivated land use efficiency in Hebei Province. Ding et al. (2014) used Topsis model to study the spatial and temporal differentiation characteristics of intensive use of cultivated land in Hebei Province.

It can be seen from the existing literature that most of the current research focuses on the evolution and distribution of land price or the analysis of intensive land use. At present, there is still a lack of analysis on the correlation between urban land price and intensive land use in Hebei Province. But in reality, the change of urban land price level is usually accompanied by the change of urban land use structure, from the above literature, it can be seen that the intensive use of urban land reflects the benign change of urban land structure. The research on residential land price and intensive use of urban land in Hebei Province is mainly through the analysis of the two, and the relationship between the two changes is obtained, so as to reflect whether the level of intensive use of land will change correspondingly when the local price changes, and what kind of changes will occur. If the actual situation is not developing according to the ideal state, according to the research results, some corresponding suggestions are put forward for the future development of intensive land use in Hebei Province, which will help to improve the level of intensive land use, ease the contradiction between people and land, and reduce the population pressure. It can also be used as a useful supplement to previous studies, help to provide support for the overall coordinated development of the land market in Hebei Province, and can also be used as a reference for other cities.

## 2. Research Methods

### 2.1. Overview of the research area

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Hebei province has 11 prefecture-level cities with a total area of 188800km$^2$. These eleven prefecture-level cities are Shijiazhuang, Xingtai, Qinhuangdao, Handan, Chengde, Zhangjiakou, Langfang, Tangshan, Baoding, Tangshan, Hengshui. In 2019, the regional Gross Domestic Product (GDP) was 3510.45 billion yuan, an increase of 260.99 billion yuan over 2018; In 2019, the per capita GDP increased by 3240 yuan compared with 43108 yuan in 2018, and the economy continued to grow. Besides, in 2019, the resident population of Hebei Province was 75,919,700, an increase of 356,700 compared with 2018. In 2019, the population density reached 404 people/km2, which is 2.74 times China's population density of 147 people/km2 in the same period; The third land survey in Hebei Province covers 20.671 million mu of urban land, an increase of 17.78% over the second land survey. In 2019, the urbanization rate was 57.62%, only 1.19% higher than that in 2018, with a difference of nearly 16%. "Land urbanization" was significantly faster than "population urbanization" (Lai & Zhao,2016; Ren & Zhang,2016).

## 2.2. Data sources and standardization

The data on land price and intensive land use comes from the Economic Statistical Yearbook of Hebei Province in 2019 and the Urban Land Price Status of Hebei Province in 2019. The measured data of residential land price level in Hebei Province is the land price monitoring data of Hebei Province in 2019. To make the data comparable, the standard deviation standardization method is used to standardize the data. The formula is:

$$P'=\frac{p-X_i}{X}$$

For the formula, P' is the normalized value; P s the original data; $X_i$ is the average of all data; X is the standard deviation of all data.

## 2.3. Exploratory spatial data analysis

### *2.3.1. Spatial autocorrelation*

Spatial autocorrelation reflects the interdependence and correlation between the research sites in the same distribution area and can analyze the spatial difference in the urban land price. Spatial autocorrelation includes global autocorrelation analysis and local autocorrelation analysis.

*i. Global autocorrelation*

Global autocorrelation reflects the spatial distribution of attribute data in the whole study area and studies whether an attribute has aggregation characteristics in the selected area. Generally, Moran's I index is used to expressing the spatial correlation degree. The formula is:

$$\text{Moran's I}=\frac{n\sum_{i=1}^{n}\sum_{j=1}^{n}W_{ij}(x_i-\bar{x})(x_j-\bar{x})}{\sum_{i=1}^{n}\sum_{j=1}^{n}W_{ij}\sum_{i=1}^{n}(x_i-\bar{x})}$$

For the formula, $\bar{x}$is the average of observed values of attribute data X in the study area; i 、 j are area codes; $W_{ij}$ is a symmetric matrix that represents the adjacent relation of n position space areas; n is the total number of study areas; The significance test formula is $Z(I)=\frac{\text{Moran's I}-E(I)}{\sqrt{\text{var}(I)}}$. Among the formula, E(I) is Moran's I expected value (Fang et al.,2013).

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*ii. Local autocorrelation*

Local autocorrelation reflects where aggregation mainly occurs. The LISA index is used to measure the spatial correlation degree of local areas. LISA agglomeration graph is used to show the spatial distribution of attribute values between regions and adjacent regions, which are high-high agglomeration (H-H), high-low agglomeration (H-L), low-low agglomeration (L-L) and low-high agglomeration (L-H) respectively.

*2.3.2. Inverse distance weighting method*

Inverse distance weighting method (IDW) is an interpolation method with the distance between the interpolation point and the sample point as the weight. One of the most commonly used spatial interpolation methods in GIS is the inverse distance weighting method, which is weighted and averaged according to the distance between the interpolation point and the sample point. The closer the sample point is to the interpolation point, the greater the weight is. IDW obtains the interpolation unit value by averaging the values of each sample point in the adjacent area. In the application of strong spatial autocorrelation, inverse distance weight is a more suitable interpolation method, which can improve the scientific and accuracy of interpolation results. The formula is:

$$Z(x_0) = \sum_{i=1}^{n} \lambda_i Z(x_i)$$

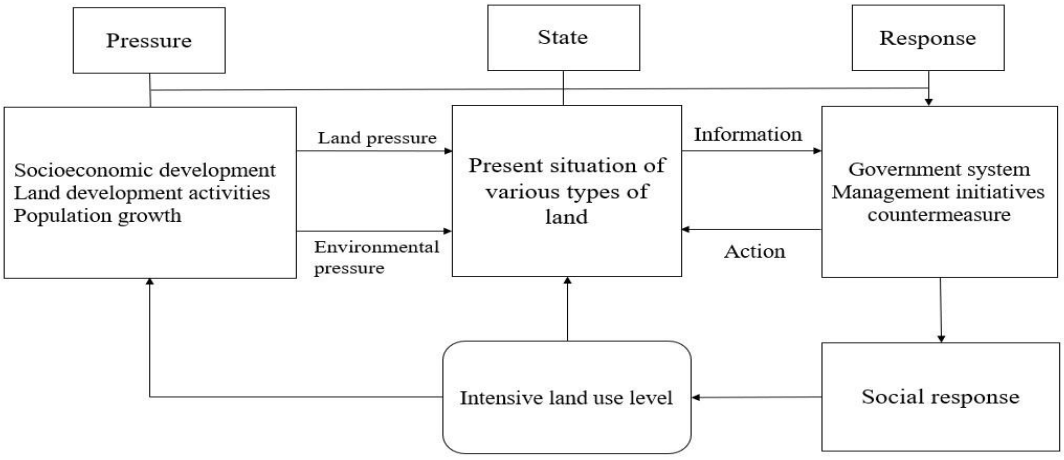
For the formula, $Z(x_0)$ is the estimated value at $x_0$. $\lambda_i$ is the weight coefficient. n is the number of land price samples. $Z(x_0)$ is the measured value at $x_0$.

*2.3.3. PSR model*

PSR (Pressure-State-Response) model reflects the single-cycle relationship between human production behavior and resources and environment in a certain period (Sun et al.,2016). The pressure of urban land use mainly lies in two aspects: first, the limited land needs to bear the pressure brought by the economy and population; second, the pressure brought by the possibility of urban land expansion and environmental restrictions to meet the needs of development (Su et al., 2011). The state of urban land use is mainly the present situation of various types of urban land, that is, the sum of economic and social benefits generated in the process of land use; The response is the response made by the government and relevant institutions to the pressure generated in the process of intensive use of urban land and the state presented at the current stage (Yang et al., 2008). As shown in Figure 2, based on the model of the man-land relationship, the index system of urban land intensive use is established. By analyzing the key factors affecting urban land intensive use, the spatial difference between urban land intensive use level and land price in each city is analyzed intuitively and practically.

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Figure 2: Analysis framework of PSR model for intensive land use




*2.3.4. Principal component analysis*

Principal component analysis (PCA) is a linear transformation, which is often used to reduce the dimension of data sets, while maintaining the characteristic that data sets contribute the most to variance. This is achieved by keeping the low-order principal components and ignoring the high-order principal components. In this way, important aspects of data can often be obtained. The PCA method firstly uses Z-score method to deal with the index dimensionless, extract the factors, judge the correlation coefficient matrix, and carry out Kaiser-Meyer-Olkin (KMO) and Bartlett spherical test to explain the correlation between variables. After that, the variance contribution rate and eigenvalue of each principal component are calculated, and the collinearity between Kaiser-Meyer-Olkin (KMO) value and diagnostic variables is calculated. In the end, the characteristic root and variance contribution rate of each principal component are calculated, and the principal components are selected according to the principle that the characteristic value is greater than 1. The formula for determining the factor weight value is as follows.

$$W_p=\frac{a_p}{\sum_{p=1}^{n} a_p}$$

In the formula, $W_p$ is the weight of the corresponding principal component factor; n is the number of principal component factors; $a_p$ is the corresponding variance contribution rate.

## 3. Results and analysis

### 3.1. Analysis of residential land prices in Hebei Province

*3.1.1. Spatial autocorrelation of land price*

SPSS software is used to analyze the spatial autocorrelation of the residential land price level in Hebei Province. In the global auto-correlation analysis, Moran's I value is 0.347, which is clustered and ranked 999 times, with a P value of 0.000, indicating that the spatial correlation is significant when the confidence is 100% (Figure 3). In order to

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make a more intuitive and concrete analysis of the spatial difference in residential land price in Hebei Province, the local autocorrelation is used to discuss the land price level in Hebei Province. As can be seen from Figure 4, Langfang, Baoding, and Shijiazhuang are high land price gathering areas; Zhangjiakou and Chengde are areas with low land prices. The land price of cities around Tangshan is relatively low, and Tangshan is a city with high land price level. Cangzhou is close to the high land price gathering area, and it is a city with low land price surrounded by high land price cities. The agglomeration phenomenon of other cities is not significant, and the land price level is in the middle level.

Figure 3: Moran's scatter diagram

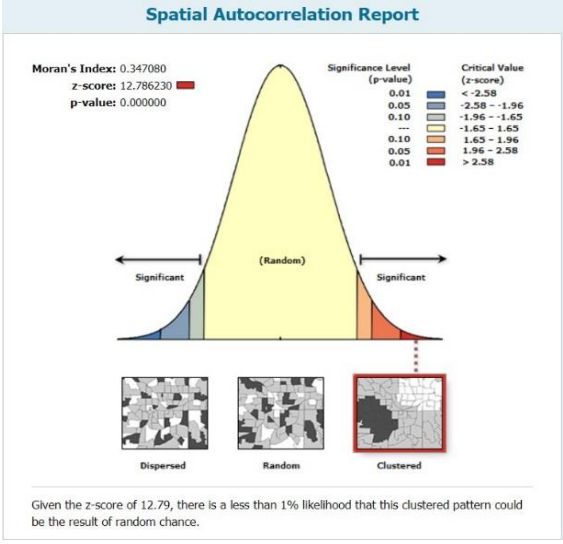
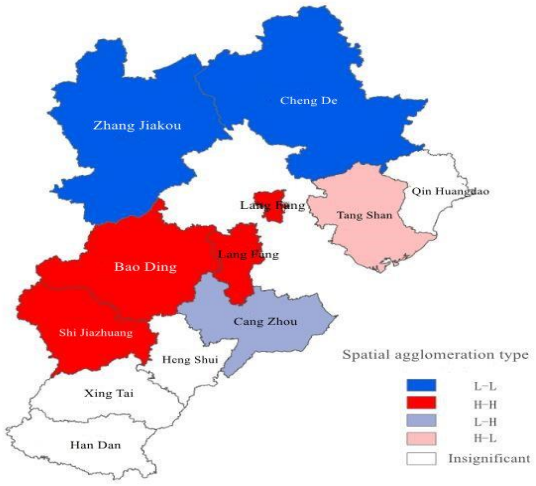



Figure 4: Land price Lisa agglomeration chart




*3.1.2. Spatial differentiation of residential land price*

As can be seen from Moran 'I value obtained from spatial autocorrelation report, and interpolation can be performed. The spatial difference map of residential land price in Hebei Province is obtained by interpolation with ArcGIS software (Figure 5). The land price level spreads outward from high to low, with Langfang as the center circle. In the Figure 5, the difference in land price in Langfang, Baoding, Shijiazhuang, Tangshan, and Qinhuangdao are small, and the diffusion in this direction is convex. It shows that

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Baoding, Shijiazhuang, Tangshan, and Qinhuangdao have higher land prices, Heng Shui, Cangzhou, Xingtai, Handan, and Chengde are at the middle level, while the land prices of Zhangjiakou in the northwest are at the bottom.

Figure 5: Land price level spatial interpolation map

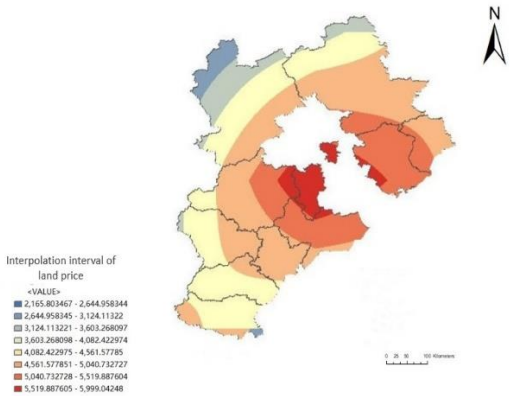
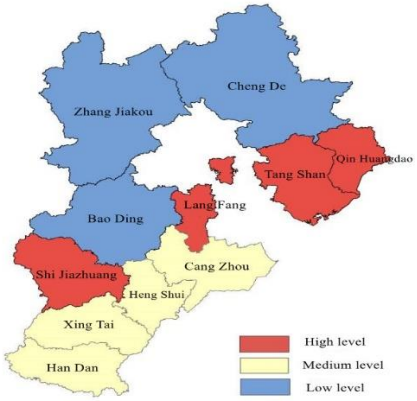



Figure 6: The diagram of urban land intensive use




## 4. Analysis of the level of urban land intensive use of urban land in Hebei Province

### 4.1. Construction of indicator system

Referring to the "Technical Plan for Urban Land Collection Use Potential Evaluation" and related documents (Zhan & Wu, 2009; Hong & Xue, 2006). Combined with the actual situation of Hebei Province, adhere to the principles of scientificity, data availability and comparability, the index system is established, which is divided into target layers, guidelines, and indicator layers. The indicator layer has a total of 12 index factors. This paper selects 20 literatures about the construction of urban land intensive use system from 2016 to 2019 in HowNet, the general library of knowledge resources in China, for statistics, and screens out the most frequently cited indicators. Among them, the selection of pressure indicators mainly reflects the pressure on the population, economy, and environment. The selection indicators are population density ($X_1$), the proportion of tertiary industry in GDP ($X_2$) and green space coverage($X_3$), the selection of indicators mainly reflects the input and output of urban land, it is divided into average fiscal revenue ($X_4$), average gross domestic product ($X_5$), average industrial output value ($X_6$), average retail sales of social consumer goods ($X_7$), average number of employees in

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secondary and tertiary industries ($X_8$) and average road area ($X_9$). The selection of response indicators mainly reflects the judgment of land investment, including urban average investment in environmental protection ($X_{10}$), average investment in infrastructure ($X_{11}$) and average investment in fixed assets ($X_{12}$) (Table 1).

Table 1: Evaluating indexes of urban land intensive use

| Target layers | Guidelines | Indicator layers | Connotation |
|---|---|---|---|
| Urban land intensive use | Pressure index | Population density($X_1$) | Judging the pressure of population on land |
| | | The proportion of tertiary industry in GDP($X_2$) | Judge the pressure of the economy on land |
| | | Green space coverage($X_3$) | Judging the pressure of the environment on the land |
| | State index | Average fiscal revenue($X_4$) | Judge the economic benefits of land |
| | | Average gross domestic product($X_5$) | Judge the economic benefits of land |
| | | Average industrial output value($X_6$) | Judge the economic benefits of land |
| | | Average retail sales of social consumer goods($X_7$) | Judge the economic benefits of land |
| | | The average number of employees in secondary and tertiary Industries($X_8$) | Judge the social benefits of land |
| | | Average road area($X_9$) | Judge the social benefits of land |
| | Response index | Urban average investment in environmental protection($X_{10}$) | Judge the degree of land investment |
| | | Average investment in infrastructure($X_{11}$) | Judge the degree of land investment |
| | | Average investment in fixed assets($X_{12}$) | Judge the degree of land investment |

*4.1.1. Standard system factor analysis*

The principal component analysis of 12 factors of the urban land intensive use index system was carried out by SPSS software. The spherical test result KMO is 0.659, which is greater than 0.5, and the Sig value is less than 0.05, that is, there is a significant correlation between variables, which is suitable for factor analysis (Zhu & Cao, 2011). In the analysis results, the contribution rate of the first three factors of the three factors is more than 85%, and the contribution rate of the variance contribution of the three factors after the rotation has changed, indicating that the information has been redistributed, but the order is still from large to small. Therefore, 53.36% of the variation depends on the first principal component, 23.24% on the second principal component, and 12.49% on the third principal component. To further analyze the three principal components clearly, the maximum variance method is selected, and the rotated factor extraction results and factor regression coefficient table (Table2) are obtained.

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Table 2: Rotated component matrix and component score coefficient matrix

| Index | Factor extraction result | | | Factor regression coefficient | | |
|---|---|---|---|---|---|---|
| | The first principal component | The second principal component | The third principal component | The first principal component | The second principal component | The third principal component |
| $X_1$ | 0.813 | -0.096 | 0.297 | 0.232 | -0.288 | 0.171 |
| $X_2$ | 0.072 | 0.199 | 0.926 | -0.082 | 0.057 | 0.640 |
| $X_3$ | 0.665 | 0.664 | 0.260 | -0.006 | 0.227 | 0.113 |
| $X_4$ | 0.815 | 0.101 | 0.453 | 0.173 | -0.174 | 0.271 |
| $X_5$ | 0.661 | 0.105 | -0.153 | 0.162 | -0.100 | -0.150 |
| $X_6$ | 0.716 | 0.549 | -0.389 | 0.074 | 0.176 | -0.342 |
| $X_7$ | 0.892 | 0.371 | 0.094 | 0.142 | -0.007 | -0.001 |
| $X_8$ | 0.763 | 0.614 | 0.163 | 0.040 | 0.175 | 0.042 |
| $X_9$ | 0.021 | 0.964 | 0.183 | -0.256 | 0.586 | 0.078 |
| $X_{10}$ | 0.813 | 0.543 | -0.007 | 0.081 | 0.126 | -0.077 |
| $X_{11}$ | 0.854 | 0.454 | -0.133 | 0.123 | 0.067 | -0.164 |
| $X_{12}$ | 0.953 | 0.179 | 0.135 | 0.207 | -0.145 | 0.035 |

SPSS statistical analysis software is used for data processing, and the standardized data of various indicators are used as variables to construct the matrix (Feng et al., 2007), getting the characteristic root of the matrix and the corresponding variance contribution rate, selecting the principal component, getting the factor extraction result and factor regression coefficient, and then calculate the scores of each factor of each city. According to the factor regression coefficient, the expression for calculating the principal component factor score can be written directly:

$$F_1=0.232Zx_1-0.082Zx_2-0.006Zx_3+0.173Zx_4-0.162Zx_5+0.074Zx_6-0.142Zx_7-0.040Zx_8-0.256Zx_9-0.081Zx_{10}+0.123Zx_{11}+0.207Zx_{12}$$

$$F_2=-0.288Zx_1-0.057Zx_2+0.227Zx_3-0.174Zx_4-0.1Zx_5+0.176Zx_6-0.007Zx_7-0.175Zx_8+0.586Zx_9-0.034Zx_{10}+0.067Zx_{11}-0.145Zx_{12}$$

$$F_3=0.171Zx_1-0.640Zx_2+0.113Zx_3-0.271Zx_4-0.150Zx_5-0.342Zx_6-0.001Zx_7-0.042Zx_8-0.078Zx_9-077Zx_{10}-0.164Zx_{11}+0.035Zx_{12}$$

In the formula, $F_1$、$F_2$, and $F_3$ are the three main component factor scores, and $ZX_1$ $ZX_2$ $ZX_3$⋯$ZX_{12}$ are standardized data.

From Table 2, it can be found that the first principal component is mainly affected by factors such as average investment in fixed assets ($X_{12}$), average investment in infrastructure ($X_{11}$), urban average investment in environmental protection ($X_{10}$), average retail sales of social consumer goods ($X_7$), average fiscal revenue ($X_4$). Population density ($X_1$) including all response indicators, which generally reflect the intensity of land use and the input-output status. The second principal component is mainly influenced by index factors such as average road area ($X_9$) which reflects the degree of influence of infrastructure perfection on urban land intensive use. The third principal component is mainly influenced by indicators such as the proportion of tertiary industry in GDP ($X_2$), which reflects the industrial structure of urban land use. From the orientation of index factors in the first, second, and third principal

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components, it can be seen that the differences in economy, policy, and land use structure are the main factors that affect intensive land use.

*4.1.2. Calculation of final score of intensive land use in cities of Hebei Province*

The above factors reflect the land use status of each city from the aspects of population, economy, environment, etc. After the scores of each principal component factor of each city are calculated by factor regression coefficient, the final scores of each city are calculated, and the scores and rankings of urban land intensive use level are obtained (Table 3). Then, 11 cities are divided into three types: high level, medium level, and high level by cluster analysis.

Table 3: Synthetic score of 11 cities in Hebei province

| City | First principal component score | Second principal component score | Third principal component score | Score | Ranking |
|---|---|---|---|---|---|
| Tangshan | 1.57 | 1.09 | -1.76 | 0.98 | 1 |
| Shi Jiazhuang | 0.78 | 1.30 | 0.40 | 0.87 | 2 |
| Langfang | 1.19 | -0.82 | 1.90 | 0.76 | 3 |
| Qinhuangdao | 0.51 | -0.05 | 0.24 | 0.33 | 4 |
| Cang Zhou | -0.89 | 1.78 | 1.11 | 0.09 | 5 |
| Han Dan | 0.61 | -1.34 | -0.34 | -0.03 | 6 |
| Xing Tai | -0.45 | -0.63 | 0.65 | -0.34 | 7 |
| Heng Shui | -0.33 | -0.40 | -0.61 | -0.39 | 8 |
| Baoding | -0.28 | -0.93 | -0.70 | -0.51 | 9 |
| Zhang Jiakou | -1.44 | 0.17 | -0.30 | -0.86 | 10 |
| Cheng De | -1.28 | -0.18 | -0.59 | -0.9 | 11 |

## 4.2. Analysis of results

*4.2.1. Analysis of the Distribution Characteristics of Urban Residential Land Price and Intensive Land Use*

As a whole, the urban residential land price shows the spatial distribution characteristics of the circle structure with Langfang as the center and gradually decreasing outward.

According to the results of the land price LISA diagram (Figure 3) and the land price spatial interpolation diagram (Figure 5), it can be seen that the areas with a higher land price of urban housing in Hebei Province are mainly located in Langfang in the central part of Hebei Province. Among them, the high-value areas are Langfang, Baoding, and a small part of Tangshan. The highest value area appears in Langfang, which is mainly affected by the shortage of land in Beijing and Tianjin. The highest land price can reach 4,920 yuan/$m^2$, while the lowest value is located northwest of Zhangjiakou, on the southeast edge of the Inner Mongolia Plateau. The land is mostly used for greening and sand prevention, so the land price level is low. When the land price expands outward, it shows different diffusion characteristics and intensities in different directions. From the center to the northwest, namely Chengde and Zhangjiakou, the land price difference is large and the gradient is obvious. However, there is little difference in land price from the center to Tangshan and Qinhuangdao. Tangshan city's land price is at a high level and

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its industry is developed. Qinhuangdao is an open and mature port city with developed tourism, which makes the difference in land price small. From the south of the center to Baoding, Cangzhou, Hengshui, Shijiazhuang, Xingtai, and Handan, the difference changes slowly.

The intensive use of urban land shows the spatial distribution characteristics of low northwest and high southeast

According to the comprehensive scores of urban land intensive use (Table 3), combined with the spatial distribution map of urban land intensive use degree of prefecture-level cities in Hebei Province (Figure 6), the evaluation results are analyzed.

The intensive use of urban land in cities of Hebei Province shows the spatial difference characteristics of high in the southeast and low in the northwest. Among them, Tangshan, Shijiazhuang, Langfang, and Qinhuangdao are high-level cities for intensive use of urban land; Cang Zhou, Handan, Xingtai and Heng Shui are the middle level of urban land intensive use; Baoding, Zhangjiakou, and Chengde are low-level cities for intensive use of urban land. From the analysis results, the main reason for the difference in spatial is economic and policy factors. Some cities in Hebei Province, such as Tangshan, Langfang, and Qinhuangdao are regions with a high level of economic development in Hebei Province, and they are also cities with high land intensive use levels in the province. Tangshan, Shijiazhuang, Langfang, and Qinhuangdao ranked first, and the first principal component scored higher, mainly influenced by economic factors. Tangshan has a high economic level, with the scores of the first principal component and the second principal component being 1.57 and 1.09 respectively, but the score of the third principal component is only -1.76, and the tertiary industry accounts for a low proportion of GDP; Shi Jiazhuang has no negative value in the three principal components, and its score in the first principal component is lower than that in Tangshan. The score of the third principal component is 0.4, which is the lowest among the three principal components. The tertiary industry accounts for a low proportion of GDP. As the capital of Hebei Province, it has a strong policy and a high level of intensive land use; The first principal component score of Langfang City is 1.19, but the second principal component is -0.82, which is strongly influenced by the Beijing-Tianjin economy. Therefore, the proportion of land use can be adjusted in urban construction; Qinhuangdao's first main ingredients and the third main component scores are 0.51 and 0.24 respectively. The second main ingredients are negative value. The main use of land intensity and urban construction structure. In cities with a medium-sized level of urban land intensive, Cangzhou's first main component is -0.89, which is mainly affected by economic and government policy factors. Compared with Langfang, Tangshan, and Qinhuangdao, Hengshui, Handan, and Xingtai are less affected by the economic impact of developed cities, and their economic driving effect is weak; The scores of Baoding, Zhangjiakou, and Chengde are all negative, Baoding's secondary industry is dominated by manufacturing industry such as automobile energy, while small-scale and low-output industries such as tourism and catering occupy a large area of land, and the land intensity is low. For Zhangjiakou and Chengde, the land use degree is not high, the economic development is backward, and all indicators are not ideal compared with other cities, so the level of intensive land use in Hebei province is low.

On the other hand, the difference in land use structure is the internal reason for the difference in the spatial distribution of urban land intensive use in Hebei Province. Tangshan, Shijiazhuang, Langfang, Qinhuangdao, and other cities have a large proportion

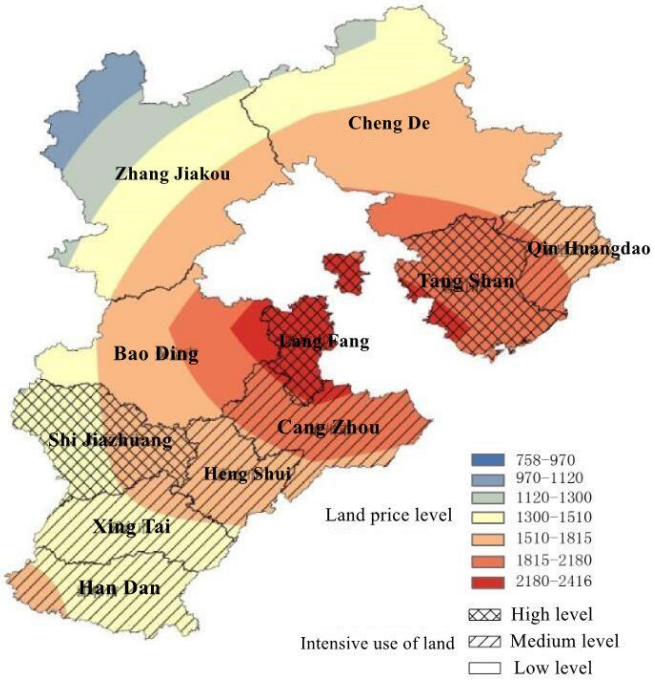
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of the tertiary industry, and their average GDP is higher than that of other cities, so their land use is intensive. Although Xingtai and Handan have distinctive economic development areas, the economic development mode is mainly processing, and most of the capital is invested in labor-intensive industries. The extensive industrial structure has a negative impact on urban land use efficiency. However, in Zhangjiakou, Baoding, and Chengde, most of the land use structures are unreasonable, the land use efficiency is low, and the level of urban land intensive use is low.

*4.2.2. Analysis of the Relationship of Urban Residential Land Price and Intensive Land Use level*

Through the intersection analysis of urban residential land price and land intensive use level (Figure 7), it can be seen that the urban residential land price level in Shijiazhuang, Langfang, Zhangjiakou, Handan, Chengde, Hengshui and Xingtai is roughly the same as the land intensive use level, and its residential land price level is directly proportional to the land intensive use level. Baoding, Cangzhou, Qinhuangdao and Tangshan are different from the intensive use of urban land. Baoding has a high land price level and a low land use intensity level, which indicates that the land potential is great, and the development of land intensity and land price growth rate is unbalanced.

Figure 7: The diagram of the land price level and land intensive use level spatial difference map




The inconsistent development of land price level and intensive use level is due to the fact that although the high demand for residential land is passively increased due to location factors, the land price only changes according to the law of supply and demand in the market, but the government fails to make timely and scientific planning of land use, which leads to extensive land use and low intensive land use in high land price areas, resulting in unbalanced development of land price level and intensive land use level and low land utilization rate, which is not conducive to alleviating the contradiction between people and land and promoting the sustained and stable growth of regional economy.

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*4.2.3. Main suggestions*

According to the above data analysis results, on the whole, from the perspective of the whole province, we should pay more attention to the development of regional intensification, strengthen management, consider land use intensification as a key factor, and make land use planning according to the land price level of each city and the actual needs of production and life. Hebei province should strive to develop towards the integration of ecological civilization and urbanization, and promote the intensive, low-carbon and intelligent urban development and construction. In addition, improving people's livelihood and strengthening people's livelihood security are the core essentials of new urbanization and building a well-off society in an all-round way in China, and the land use work in Hebei Province must also be carried out around this core. Protecting ecological environment and improving people's livelihood are two important strategic bases of land use in Hebei Province. Based on the strategic layout of new urbanization development, the land use policy should be adjusted according to the actual situation, and the existing land development mode should be changed. In order to change the existing extensive land development mode, it is necessary to combine the existing regional industrial development layout with the resource endowment advantages, industrial base and development direction of all cities in Hebei Province, and determine the development orientation of leading industries and urbanized areas, so as to help the efficient and rational use of limited land resources and promote the intensive and efficient land development mode of regional development. Adjusting the proportion of urban residential land and reducing people's housing pressure, transforming the land use situation whose layout does not meet the needs of urban development and affects the intensity of urban land. At the same time, speed up the reform of urban household registration system, adhere to the principle and policy of coordinated development of large, medium and small cities and small towns, take the road of urbanization with Chinese characteristics, and improve the level of urbanization while the economic level of cities is developing rapidly. In the process of realizing urbanization in Hebei Province, especially in the actual land development and utilization, it is necessary to fully safeguard and protect the quality of life of residents in the developed areas and the actual rights and interests of farmers who have lost their land. Therefore, the key point is to formulate and improve the diversified compensation mechanism for land requisition and humanized house demolition system, safeguard people's interests from a policy perspective, and ensure people's livelihood. To know the situation of land use in time, so as to help strengthen the practicability and scientificity of subsequent land policy formulation. Transforming and upgrading traditional industries, and integrating the information concept into industrialization. At the same time, increase investment in high-tech industries and promote the economic transformation from manufacturing to high-tech industries. Improving the service level, promoting the balanced development of urban land intensive utilization rate and land price growth rate, and realizing the coordinated and healthy growth of land price level on the premise of scientific urban planning and high-grade intensive level.

Specifically, Tangshan City should actively adjust the industrial structure, vigorously develop the service industry, and selectively undertake high-end and high-quality industrial projects. Focusing on establishing high-tech industrial bases, measuring the impact of urbanization on population, and reducing the pressure on residential land. Shijiazhuang should focus on tapping the land potential inside the city, optimizing the planning and construction of the central city, making scientific use of the existing land, developing the commercial logistics service center, and striving to build a livable

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provincial capital city. Langfang should lay out the industrial types from the overall perspective, strengthen the construction of the e-commerce industry, and strive to build a business and leisure center. Qinhuangdao should vigorously develop the tertiary industry, establish a seaside recreation center, give full play to the comparative advantages of the industry, realize the orderly expansion of the city scale and improve the quality of people's living environment. Cangzhou should increase the planning investment in urban development, develop the fine chemical industry and bio-pharmaceutical industry, promote regional economic development, increase fiscal revenue and improve people's living standards. Handan should vigorously develop the tertiary industry, transform high-energy consumption industries into manufacturing industries with higher added value, improve land intensity, establish advanced manufacturing bases and strive to build a hub city linking Hebei Province with the central plains, adjust land use types, increase residential land, and reduce the contradiction between people and land. Xingtai city should strive to promote the transformation of the industry from high consumption to high efficiency, changing the original agricultural land-use mode, improving the economic benefits of land, and paying attention to ecological benefits, to realize the ecological intensive use of urban land. Hengshui city should rationally lay out infrastructure and basic industries, focus on developing high-end equipment manufacturing and modern service industries, and build a lakeside city suitable for people to live in. Baoding can increase the proportion of high-tech industries and residential land area, reduce people's living pressure and improve land utilization rate. Zhangjiakou and Chengde should vigorously develop the tertiary industry, optimize the urban industrial structure and layout, increase the investment in urban infrastructure, adjust the land use structure, improve the overall economic level and promote the return of population, so as to improve people's living standards and change the shortcomings of the existing backward indicators. From the overall improvement of urban land intensive use level in Hebei Province, the optimal allocation rate of land resources and the land price growth rate will develop synchronously, improve the living quality of urban residents, and promote sustained and steady economic growth.

## 5. Conclusion

The spatial distribution of residential land price in Hebei Province was analyzed by using exploratory spatial data, and the index system of urban land intensive use was constructed based on the PSR model. The level of urban land intensive use in Hebei Province in 2019 was comprehensively calculated, and the analysis results were analyzed and discussed. The residential land price in Hebei province shows the spatial distribution characteristics of gradually decreasing outward with Langfang as the center.

On the whole, the situation of urban land intensive use in Hebei province shows a spatial distribution pattern of "high in the southeast and low in the northwest", among which Tangshan, Shijiazhuang, Langfang, and Qinhuangdao are the high-level cities of urban land intensive use; Cangzhou, Handan, Xingtai, and Hengshui are the middle level of urban land intensive use; Baoding, Zhangjiakou, and Chengde are low-level cities for intensive use of urban land. The main influencing factors of this situation are economic factors, government policy factors, and differences in land use structure. According to the analysis results, some suggestions are put forward that we should pay more attention to regional intensive development, strengthen management and tap the potential of urban land. The evaluation results show that the evaluation results obtained by using the exploratory spatial data analysis method to express the land price level and

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introducing the PSR model to evaluate the intensive use of urban land can objectively and practically reflect the spatial differences between the urban land price and the intensive use level of urban land in the study area.

The spatial distribution of urban residential land price and intensive land use level is different. Baoding has a high land price level, but the intensive land use level is at a low level. In addition, Cangzhou, Qinhuangdao, and Tangshan have different levels of residential land price and intensive land use level. We should tap the land potential according to the specific conditions of each city, so as to improve the land use structure and efficiency.

The performance of the urban residential land price and land intensive use level is staged, which needs to be adjusted according to the actual situation. The land price and land intensive use of commercial land and industrial land should also be studied in the follow-up, and the evaluation should also consider the time factor. Combining time and space for research and analysis will be the main research direction in the future.

**Funding**

This study received no funding.

**Conflict of Interests**

The authors reported no conflicts of interest for this work and declare that there is no potential conflict of interest with respect to the research, authorship, or publication of this article.

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