Drought climate change in a mountainous area based on dynamic space and green economic efficiency of high-tech industry

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Abstract
In this paper, based on the dynamic space of drought climate change detection in mountainous areas, an in-depth study on the green economic efficiency of high-tech industry is carried out. Under the background of climate change in mountainous areas, this paper puts forward some reference suggestions by concentrating the structural sequence of “layer structure” in the form of mountain climate landscape and incorporating it into a unified dialectic design concept. The process derived from layer construction not only is the process of continuous concept extraction and construction in dynamic space design, but also represents a new strategic method and direction guide for exploring dynamic space theory, and represents an important point for the rational development of current and future dynamic space. The modernization of high-tech industry is not only the driving force of material and economic development, but also the solid foundation of sustainable development of real economy. Among them, the financial market is an important way of real economy action. Close monitoring of financial markets and modernization of their industrial structure can reduce the financing opportunities that deviate from IMF. The existence of financial market in the process of industrial structure modernization is conducive to the formation of a sound industrial structure, and the effective cooperation between financial market and high-tech industrial structure modernization will promote the real economic development. Therefore, it is of great significance to systematically study the impact of financial development, industrial structure upgrading, and the integration of the two on the real economy. In this paper, the drought climate change in mountainous areas and the green economic efficiency of high-tech industry are studied, and applied to the dynamic space, aiming to promote the application in practice.

Keywords Dynamic space - Arid climate in mountain area - High-tech industry - Green economy efficiency

Introduction
For the study of the relationship between dynamic space and “layer structure”, in the face of the lack of spatial layers caused by various reasons in the current drought climate change in mountainous areas, the purpose of the study on the reproduction of “layer structure” in the dynamic spatial order of drought climate in mountainous areas is to seek to eliminate the entangled dynamic spatial form again and again by adjusting the layout, proportion reconstruction, and boundary reconstruction. It transforms the individual perception of space into the physical meaning of the dialogue between space and people; at the same time, the hierarchical representation of order tries to find and establish an organic hierarchical structure of dynamic space, which can realize the whole from the part, but there are also differences (Sabina et al. 2005). As an important force in the economic development of every big city, high-tech industry, as a savings institution of enterprises, is leading the new engine of regional economic growth. Green development is very important today. However, the research on the efficiency development of green economy in industrial parks has not yet been completed, and the main research is still focused on the low-carbon construction of eco-industrial parks and industrial parks. However, the green development of industrial parks is a new trend of
the new normal of the current economy, and also a new development of the combination of ecological civilization and low-carbon circular economy (Shriadah et al. 2004). The development of green economic efficiency has become an important part of the five principles of China’s new era development, and improving the efficiency of green economy is the fundamental demand of green development (Youssef and El-Sorogy 2016). As a strategic industry of economic development, high-tech industry has significant advantages in reducing energy efficiency and promoting economic restructuring, which is an important energy activity to achieve green development. Taking 30 provinces in China as samples, this paper expounds the accumulation mechanism of high-tech industry on green economic efficiency through theoretical analysis (Wake 2005). This paper constructs and analyzes the dynamic panel model which makes full use of system-wide moment method (SGMM), such as the impact and path of high-tech industrial agglomeration on green economy efficiency and its decomposition factors, and the impact of different types of accumulation on green economy efficiency (Touliabah and Elbassat 2017). We will show the promotion and restraint mechanism of environmental laws and regulations; strengthen environmental laws and regulations, so as to eliminate low-tech companies; and retain high-efficiency companies. At the same time, we will encourage industry innovation and take policy support and preferential tax measures to promote the development of high-tech industries to high-tech direction. There is a need to change the concept of development, change the economic development from simple quantity increase to quality development, and promote the green development of local economy (Venkatramanan et al. 2014). We will actively promote the construction of new urbanization, strengthen economic growth, and realize sustainable development. In the process of opening up, we must pay more attention to the quality of foreign direct investment, make the region become a high-tech industrial cluster, and strive to promote the development of high-quality green economic efficiency (Zhang et al. 2018).

Materials and methods

Research data

In this study, we gave 132 meteorological stations in the relatively complete time series of mountain areas (the basic meteorological elements daily data set V3.0) of national ground meteorological stations in China. The potential height, vertical velocity, temperature, and measured data are also included. The sub-elevation index of the Western spine provided by China Climate Center is 500 hPa per month.

Research methods

Dynamic space model

As shown in Figure 1, it is assumed that the green economic efficiency level of high-tech industrial agglomeration area is low in the early stage; (b) the curve will produce technology and scale effect with the accumulation of high-tech companies in the region. The technical effect is an expression of competition and cooperation among each high-tech company. In order to improve the market competiveness, high-tech companies constantly innovate and improve the technical level, and learn and innovate with each other by using the knowledge spillover in the accumulation area, so as to improve the technical level of the whole concentration area. If not in certain circumstances, the expected output will be improved, namely, from point A to point B. The green economic benefits have been raised from low to medium. Scale effect is mainly the public social resources of the company, showing the scale effect, improving the utilization rate of public resources of the expected production of the unit, reducing the expected production, and improving the green economic benefits. That is, it moves from point A to point D. Through the joint action of scale economy and technology economy, it can be seen that the improvement of green economic efficiency is realized by the principle of adding vector from a point to point C.

Based on the research of a certain person, this paper makes an appropriate expansion and adopts the following form of production function.

\[ Y_{it} = A_{it}(-)F(K, L, E) \]  \hspace{1cm} (1)

The components of Hicks’ efficiency are multiple, namely:

\[ A_{it} = g(hia) = A_{D0} \cdot e^{\delta} \cdot hia_{it}^{\beta} \]  \hspace{1cm} (2)

Fig. 1 The mechanism of high-tech industrial agglomeration on green economy efficiency
Substituting Eq. (2) into Eq. (1), and dividing both sides of the equation by \( F(K, L, E) \) at the same time, the equation about green economy efficiency is obtained, that is:

\[
\text{GEE}_{it} = Y_{it}/F(K, L, E) = A_{i0} \cdot e^{\theta_l} \cdot \text{hia}^{\beta_l}
\]  

(3)

Equation (3) shows that the efficiency of green economy is determined by \( K, L, \) and \( E, \) and influenced by HIA. Taking the natural logarithm on both sides of Eq. (3), we can further obtain the green economy efficiency equation, namely:

\[
\ln \text{GEE}_{it} = \ln A_{i0} + \theta_l + \beta_l \ln \text{hia}_{it}
\]  

(4)

The first-order lag term of green economy efficiency is introduced into the model as an explanatory variable to analyze its inertia effect and dynamic change. In order to test whether there is crowding effect, on the basis of Eq. (4), the square term of the logarithm of industrial agglomeration value is introduced into the model.

\[
\ln \text{GEE}_{it} = \alpha + \beta_0 \ln \text{GEE}_{it-1} + \beta_1 \ln \text{hia}_{it} + \beta_2 \ln^2 \text{hia}_{it} + \gamma X_{it} + \nu_i + \tau_l + \mu_{it}
\]  

(5)

The high-tech industry mainly includes the production of information chemicals and the production of medical equipment and equipment meters. The degree of industrial agglomeration can be reduced by means of inter-regional, HHI index, and EG index. In contrast, because the liberation of regions can eliminate the scale difference between regions and more real spatial distribution of high-tech industries, the level of industrial agglomeration is measured by the region, and the calculation formula is as follows:

\[
h_{ia} = \frac{\sum_i e_{ia}}{\sum_i e_{ia}} / \frac{\sum_r e_{ir}}{\sum_r \sum_i e_{ir}}
\]  

(6)

### Drought climate evaluation model

The drought classification in SPEI refers to the classification standard of drought grade in SPEI (See Table 1 for details).

\[
\text{PET} = 16K \left( \frac{40T - 1}{1} \right)^m
\]  

(7)

| SPEI value | Drought grade        |
|------------|----------------------|
| −1 < SPEI < −0.5 | Light drought       |
| −1.5 < SPEI < −1  | Moderate drought     |
| −2 < SPEI ≤ −1.5  | Shige early          |
| SPEI ≤ −2        | Extreme drought      |

The potential evapotranspiration was calculated by Thornthwaite method.

The interpolation of precipitation and potential evapotranspiration is as follows:

\[
D_i = \frac{P_i - \text{PET}_i}{\text{PET}_i}
\]  

(8)

\( D_i \) was normalized and the probability distribution was calculated by a three-parameter log logistic method:

\[
F(x) = \left[ 1 + \left( \frac{\alpha}{x - \gamma} \right)^3 \right]^{-1}
\]  

(9)

### Experimental design

The Indian Summer Monsoon Index used in this paper is the circulation index (WYI), which is the vertical variation of the summer monsoon. It is the vertical wind variation obtained by subtracting the mean latitudes of 850 hPa and 200 hPa between 40 and 110 °C and 0 °C and 20°.

Wavelet analysis in this process and analyze the time scales of various signals, can obtain significant time series wave characteristics and dynamic time structure of packet periodic change, can well express the local characteristics of signals in the time and frequency range, and has the characteristics of multi-resolution analysis. In this paper, the energy spectrum of wave drop is calculated by role wave, and the wave scale with a series of elements and wave volume level in time domain are analyzed, and the time is the average power spectrum of wave in the period, so as to obtain the complete spectrum of wave, and the periodic wave characteristics and intensity of element series time are defined.

The common methods to measure economic benefits are stochastic frontier analysis (SFA), soloban method, and data envelopment analysis (DEA). SFA and soloban methods make strong assumptions about random terms. These errors may bias the estimation, but DEA which is not a parameter estimation can be avoided. The research shows that the SBM model based on DEA is more recognizable in the efficiency of green economy. In addition, by obtaining the super SBM-DEA model in addition to the SBM model, this is a more comprehensive assessment of green economic benefits in 2019. On this basis, this paper chooses the UWB-DEA model to improve the green economic benefits.

### Results

#### Temporal and spatial evolution of arid climate in mountainous areas

Based on the temperature and precipitation data from 132 meteorological stations in Southwest China, it is found that the cumulative drought intensity is relatively small in the
central C, southeast C, g-south, x-central and western regions, and most of the u-regions. In the areas with relatively low cumulative drought intensity, the number of drought events is less than 8 years, and the most common drought events are in Nanxi, Songyuan, and southwest of C province. From the perspective of average drought duration, the areas with low cumulative drought intensity and relatively few drought events have longer average drought duration, and the average drought process in western g province continues. As shown in Figure 2.

Figure 3 shows the characteristics of average drought intensity and drought coefficient in Southwest China, which change year by year. The sum of the values of SPEI-0.5 or below for each section is decomposed into the total number of stations that have constructed the drying intensity time series in Southwest China in recent 55 years, and the lower the slope is, the stronger the drying intensity is (Fig. 3a). The decrease of drought intensity in Southwest China showed an obvious downward trend (−0.48/10a). The drought intensity has become more and more serious since, showing a slight change of inter-generational change, especially the most serious drought intensity in recent 55 years. The sum of the monthly station coefficients in Southwest China over the years is 12, which is the temporal variation sequence of the average coefficients of drought stations in recent 55 years (Fig. 3b). The drought coefficient in Southwest China increases with time (2.7/10a), and the drought-affected area increases year by year. The annual change rate is consistent with the drought intensity. The average drought station ratio in Southwest China is 37; especially, the drought related area is 47.7%.

In order to obtain the time variation characteristics of the time period, different from the average drought intensity and drought coefficient of stations in Southwest China, the frequency spectrum wave energy analysis of stations in Southwest China is analyzed by using the wave lightning method (Fig. 4). As shown in the figure, the periodic variation characteristics between the station average drought intensity and drought coefficient in Southwest China are almost the same, and within the boundary effect range, the station average drought intensity and drought coefficient change half a year, with a 7–10-year cycle.

Distribution of temperature and precipitation in arid climate of mountainous area

In this paper, the distribution of seasonal annual precipitation in Southwest China is analyzed by the combination of drought and waterlogging. The annual variation of

![Fig. 2 Spatial distribution of cumulative drought intensity, number of drought events, and average duration of drought in Southwest China](image-url)
seasonal precipitation shows that in spring, the areas with less precipitation in Southwest China are mainly located in G and X areas, and the precipitation is less than 30 mm compared with that in flood years. The precipitation in the north and southwest of China is more than that in the flood years, and the positive anomaly intensity is weaker than that in the flood years. The precipitation in dry years in Southwest China decreases seriously in summer, and the precipitation in S, Y, and G is extremely less than that in flood years. The center of the maximum negative anomaly is located in Y area. Compared with summer, the intensity and range of negative anomaly of precipitation in autumn drought flood years are decreased. The negative anomaly of precipitation is distributed in Southwest China, and the
center of negative anomaly is mainly located in Yunnan Province. In winter, the precipitation in most areas of Southwest China is evenly distributed in the drought flood years, and the intensity is obviously weakened. The center of the negative anomaly is mainly located in the south of Y, and the precipitation is 9–12 mm less.

From the seasonal variation of precipitation, it can be seen that under the arid climate, the precipitation in Southwest China is seriously absent in summer. In spring and autumn, the areas with less precipitation are mainly located in the south of Southwest China. In winter, the precipitation in Southwest China decreases all over the region, and the intensity is weak (Figure 5).

The seasonal variation distribution of solar term temperature in Southwest China (Fig. 6) shows that the average temperature in dry year in spring is higher than that in flood year, which is a positive anomaly distribution. The center of positive anomaly of temperature is located in the western region of Y, and the temperature value is about 0.8 °C higher than that in flood year. In summer, the intensity of positive anomaly is weaker than that in spring, and the center of positive anomaly is located in southwest and northwest Yunnan. The average temperature in Southwest China in autumn is only 0.2–0.4 °C, higher than that in flood years, and the positive anomaly intensity of temperature decreases with the change of spring, summer, and autumn. The average temperature anomaly change in Southwest China is the most significant in winter, and the positive anomaly intensity is the strongest in four seasons. The positive anomaly intensity in Southwest China increases evenly from east to west, and the maximum positive anomaly value in Southwest China is about 1.2 °C in the West.

The seasonal precipitation and temperature changes in Southwest China have different degrees of influence on drought. They show a good correlation with drought changes in summer and autumn, and the relationship between drought and temperature changes in winter, and spring is relatively close. The following will discuss the impact mechanism from these two aspects.

In order to better explain the relationship between Indian Summer Monsoon Index and summer precipitation in Southwest China, the definition of summer precipitation interval less than 0 is defined as the juvenile precipitation and the precipitation interval is more than 0 as the years of precipitation bias. According to the percentile method, the 25th percentile is regarded as the index of Indian summer monsoon intensity; then the Indian summer monsoon index greater than 0.6 is defined as the year of monsoon partial intensity and less than −0.6 as the year of monsoon bias. It is found that there are 17 strong summer monsoon years (more than 10 years of precipitation and 7 years less), 15

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**Fig. 5** Surface precipitation anomaly in four seasons: spring (a), summer (b), autumn (c), and winter (d)

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weak monsoon years (more than 6 years and 9 years less precipitation), and 23 normal monsoon years (13 years more precipitation and 10 years less). In the year of strong summer monsoon, the precipitation in Southwest China accounts for a large proportion, while in the weak year of summer monsoon, the less precipitation in summer accounts for a larger proportion. From another perspective, the summer precipitation in Southwest China is more than years, and the normal and strong summer monsoon in India accounts for a large proportion, whereas, in summer, the precipitation is juvenile, and the normal and weakened summer monsoon is the majority, as shown in Table 2.

Circulation situation of arid climate in mountainous areas

Figure 7 shows the distribution of 500 hPa average height field and the composite distribution of drought waterlogging height difference field in winter and spring. Under the dry climate in winter and spring, the East Asian Trough weakens and moves eastward, the low trough is located in the North Pacific in the middle and high latitudes, the trough ridge line is slightly north compared with the waterlogging year, the main body of the subtropical high in the West Pacific is near 15°N, and the high ridge in the Central Asia is strengthened. The potential height of spring drought flood years shows that the South China Sea controlled by the Western Pacific subtropical high, and the position of the subtropical high in the dry year obviously retreats to the East compared with the flood year, and the Western ridge of the subtropical high in the dry year is near 115 °E.

The temperature anomaly distribution of latitude height in winter and spring shows that in dry spring (Fig. 8a), there is an obvious warming phenomenon in the middle and high latitudes from the upper layer to the lower layer at 1000–100 hPa, and the positive temperature anomaly of the lower layer at 1000 hPa near 80–90 °N is more than 3 °C. In the latitude range of Southwest China, the temperature variation over 1000–200 hPa is in a positive anomaly distribution, while that over 500 hPa and 250 hPa 40 °N is in a positive anomaly distribution. There is a weak negative temperature anomaly near n, which indicates the weakening of cold air activity over Southwest China. In dry winter years (Fig. 8b), the cooling area at 700–100 hPa in middle and low latitudes inclines northward with the decrease of altitude. The center of strong negative temperature anomaly is near 50 °N at 100 hPa, and the anomaly value is less than −3 °C. The negative temperature anomaly area at 300–200 hPa inclines southward slightly, showing a weak northerly air flow. In Southwest China, the temperature anomaly distribution is obvious at 1000–300 hPa, and the center of the maximum value of the positive anomaly is located at 700–500 hPa, and the anomaly value reaches 2.4 °C.
Empirical results of green economy in high-tech industry

The system-wide moment method (SGMM) was used in the regression analysis. The significant value of lnGEE coefficient and l1nGEE coefficient in Fe estimation was 1%, which met the bond’s criteria (Table 3).

The regression results are shown from model 5 in Table 4 to model 10. As shown in model 5 and model 10, the diversification of high-tech industries has a significant effect on improving the efficiency of green economy, which shows that the diversification of high-tech industries is beneficial to improving the efficiency of green economy. This may be because inter-industry differentiated companies can create more technology and knowledge flow in the spatial industrial structure of high-tech industry diversification accumulation, form the power of technological innovation, and promote the improvement of green economy efficiency.

Discussion

Analysis of drought climate change in mountainous areas

The drought intensity of southwest region was obviously increased after 2002, and there was obvious interannual anomaly. The SPI value in summer and autumn is significantly correlated with the increase of temperature, and the SPI value in summer and autumn is significantly correlated with precipitation and temperature. In arid climate, the intensity of negative precipitation intensity in the southwest region is obviously increased in summer and autumn, while the positive abnormal change of temperature is more obvious in winter and spring (Alharbi and El-Sorogy 2019). The results of the analysis of the circulation characteristics and the causes of drought in each season are as follows:

A. In winter and spring, the subtropical high of the West Pacific appears to move eastward on the high-rise 500 hPa, the meridional circulation in the middle- and low-latitude areas of East Asia is weakened, and the westerly jet anomaly appears in the troposphere high level, which corresponds to the weak winter wind in the southwest region on the lower layer 850 hPa, which results in the slightly higher temperature in Southwest China in dry climate than in the flood year (Batayneh 2010).

B. The latitude height profile of temperature shows that the temperature in Southwest China is normal in vertical height in winter and spring, and the north air flow of high-rise is decreased in 200 hPa, indicating that there is no obvious strong cold air activity over the southwest area. In winter and spring, the high and low temperature in the southwest region and the weakening of winter wind are one of the reasons for the drought in this area.
C. In summer and autumn, the subtropical high of the West Pacific can be maintained stably under the action of the high-rise 100 hPa and the South Asia high, and it is obvious that it enters the West and controls the Southwest China. The trough ridge fluctuation in the middle and high-latitude area is weak at 500 hPa, which is not conducive to the cold air advancing southward (Bazzi 2014). The weakening of cold air and the continuous control of the secondary height are beneficial to the development of the high temperature and low rain weather in Southwest China.

D. In summer and autumn, the water vapor transport in the dry year in Southwest China mainly comes from the Northwest Pacific Ocean, and the water vapor diffuses in advance during the transportation process, which leads to the weakening of water vapor intensity in Southwest China. In summer, the intensity of the high-latitude westerlies is weakened, and the intensity of the westerlies in autumn is enhanced, and the precipitation in southwest is difficult under the condition of lack of water vapor.

E. As an important water vapor transport channel, OLR changes in the area are characterized by OLR negative offset and active vertical convection in summer; in autumn, OLR was flat and water vapor transport was weakened. The OLR of Southwest China was positively abnormal in summer and autumn, which was controlled by strong downwelling, which led to the weakening of water vapor intensity in the region.

F. The sea temperature anomaly in summer and autumn indicates that the Pacific region shows a weak ranina state, and the northern Indian Ocean has a significant warming, which leads to the weak monsoon and less precipitation in the southwest.

Analysis on the stability of green economic efficiency of high and new technology industry

In order to verify the robustness of the results, the robustness of the model is verified by replacing some variables. That is, energy consumption intensity (energy) and education investment (EDU) replace the foreign direct investment (FDI) and urbanization level (urb) in the above. Therefore, it is believed that the green economic efficiency and the direction and level of action considered by the main explanatory variables in the case agree with the above regression results, and the expected results are stable (Diagomanlin et al. 2004).

### Table 3: Regression results of the impact of high-tech industrial agglomeration on green economic efficiency

| Explanatory Variables | Model 1 | Model 2 | Model 3 | Model 4 |
|-----------------------|---------|---------|---------|---------|
| \( \ln\text{CEE} \)    | 0.6833 ***(137.54) | 0.670*** (21.88) | 0.6702*** (13.52) | 0.9525*** (49.72) |
| \( \ln\text{hia} \)    | 0.1742 ***(80.94) | 0.0986*** (7.25) | -0.0116 (0.39) | 0.0219* (2.36) |
| \( \ln\text{hia} \)    | 0.0259 ***(27.51) | 0.0156*** (5.24) | -0.0084 (0.84) | 0.0059* (1.79) |
| \( \ln\text{ER} \)     | 0.0170*** (6. 90) | 0.0049 (0.56) | 0.0016 (0.23) |
The current situation of green economy development of high and new technology industry

Enterprise resources fail to be recycled

At present, among the eight industries introduced by the high-tech industrial development zone, the optical plug LED industry and biomedical manufacturing industry have formed a complete industrial chain. Other industries have not shown the transnational action among industries, and are also very unfavorable for the sharing of industrial resources and the balance of ecological environment, which has formed a symbiotic ecological effect (El Sayed 2002). Field research shows that some companies still adhere to the traditional industrial economy, discharge the waste gas generated in the production process to the air and the surrounding water without any wastewater treatment, and also dispose the waste to professional companies, resulting in waste of resources.

The goal of clean production is not reached

The research shows that some residential companies purchase low-cost, high-brightness, and high carbon emission materials. In order to maximize the profits in the production process, they do not strictly control the environmental protection measures, reduce the pollution and emission caused by raw materials and production process dirt, and eventually lead to a large amount of waste, which we have to deal with seriously. Otherwise, its impact on the natural environment should not be underestimated (Ghandour and Haredy 2019). These companies, which are production-oriented and do not neglect cleaning, are not uncommon in high-tech industrial development zone. However, whether it is a company or a small workshop that is not known to be known, such violation of the construction of Ecological industrial park will cause long-term adverse damage to the environment and will not be conducive to the greening development of residential complex.

Low investment threshold

As a national ecological park, high-tech industrial development zone should raise funds according to the environment, just as it has done in attracting investment. However, some problems have been found in collecting materials and interviewing housing managers. Because the location of the middle area is not ideal, its capital cannot catch up with other high development cities, and its investment attraction is low. In attracting foreign investment, there are several excellent companies, so it is inevitable that some failed companies and polluting companies will mix together (Guerra et al. 2009). In this way, the location of the whole residential area will be disrupted, and the ecological balance of the whole residential area will be disrupted, which will bring great damage to the green development of the residential area.

The development of the park ignores low carbon and environmental protection

At present, most industrial parks are exploring low-carbon construction, and high-tech industrial development zones are no exception. From the design to now, residential areas have to be built through local production according to the environment, climate, and economic conditions of residential areas. However, from the perspective of low-carbon planning, it is not mature, and there are no suggestions to reduce greenhouse gas emissions from residential areas and buildings. Due to the limitation of economic conditions, the low-carbon plan is also restricted by many aspects (Guieu et al. 1997). In addition, the use level of renewable energy and new energy in residential areas and the development prospect of residential areas are very poor, which cannot meet the demand for low-carbon energy. Finally, even in the residential complex, it is not conducive to the effective promotion of the concept of low-carbon environmental protection, lack of professional publicity, and planning mechanism.
Weak management

As a government department in the management of high-tech industrial development zone, the trustee has some defects in the management organization, and cannot successfully coordinate the relationship between the company’s interests and social and economic interests. The results show that the environmental management policy cannot meet the needs of residential greening. Secondly, the government does not provide periodic economic indicators that specific companies can refer to, such as pollutant emission indicators, waste loss indicators, and so on. They have no right to review or punish urban planning as the environment that administrative departments use to protect public facilities. First, enforcement and prestige are low. Secondly, it is not enough to promote information disclosure, campus transparency, and inter-company information exchange. And according to the survey results, about 50% of people are dissatisfied with the transparency of campus information disclosure.

High-tech industry green economy efficiency development strategy

Improving the development mode of circular economy

In the new economic norms, the greening of high-tech industrial development zone is necessary for the development of circular economy to be in a prominent position. Only through the rational use of resources can the environment be protected, and the road of sustainable development has green mountains. In order to meet the needs of the development of a circular economy, the companies in the high-tech industrial development zone should establish symbiotic networks, recycle all kinds of products and wastes, use energy and water resources step by step, and share infrastructure and technology (Hariri and Abu-Zied 2018). In addition, from the circulation of enterprises, we will realize circulation in residential areas and realize large circulation in society. Therefore, it is necessary to improve the development of circular economy in residential areas from the aspects of industrial symbiosis system construction, public infrastructure construction, and social environment.

Establish incentive mechanism for environmental protection

There are also some adverse factors in the development zone, such as, a large amount of waste gas, safety and poor-quality products, and other pollution problems. In addition to the green transformation of residential complex, green production also needs to be improved, and green consumption needs to be induced. Enterprise green production is formed from the development of feasible green products, the selection of renewable energy, and the selection of green pollution-free raw materials, green factories, green packaging, processing, and other aspects. Green production in all fields requires companies to invest enough funds. Although many companies are still in the stage of market survival and profitability, it is difficult to carry out green production in all fields. However, the supervision of the government and departments in the management of housing complex is weak, which makes fewer companies realize cleaner production in housing complex (Hedge et al. 2009). To fundamentally change this situation, we must establish an incentive mechanism for environmental protection.

Green investment promotion and backward production capacity exit

At present, the high-tech industry has great potential for development. It has great convenience and ecological environment, and has a broad development prospect: First-class conditions, clear industrial agglomeration, distinctive characteristics, rich human resources, and diverse platforms. There are five people living in the residential area and the advantages of maintenance, but there are few considerations from the social benefits of enterprises. The economic benefits are considered to be greater, and the enterprises with more pollution and high emissions are transferred to the residential area. The green transformation of the industrial park under the new economic norms needs strict management from the perspective of green supply of residential complex, blocking the root pollution of enterprises and strengthening the low-carbon orientation. First, set a high environmental threshold; for example, set various environmental indicators, such as domestic sewage treatment level, comprehensive rate of industrial solid waste in the USA, flexible SO2 emission module, flexible CO2 emission module, and industrial reuse ratio, and select low-carbon companies with high economic benefits among them. Next, through comprehensive consideration and coordination of various fields, we can achieve the following goals: We will expel companies with serious pollution in residential areas, low overall efficiency, and lagging production capacity, and strive to build new green industrial parks to attract more green production companies. Finally, the park should strengthen the promotion activities in software outsourcing industry, invention industry, and technology finance industry. These industries have a high level of science and technology content, and are low-pollution, low-cost, and high-income industries, which are most in line with the development needs of high-tech industries.

Conclusion

Economic norms put forward new requirements for the civilized ecological construction and environmental protection
activities of industrial parks. As the first productive industrial park with a value of 100 billion yuan, a high-tech industrial development zone should play an innovative and exemplary role from the perspective of greening development. This paper analyzes the field research results, data, and materials; finds the constraints of high-tech industry; deeply understands the high-tech industrial development zone; carries out symptomatic treatment; and puts forward the methods of green transformation of the high-tech industrial development zone. According to the new economic norms, text retrieval has a good reference role for the development of high-tech industrial development zone, has a benign role for the development of high-tech industry, develops under favorable conditions, and can promote the development of green economy. However, there are still limitations in this paper. The new economic norms are still in the primary stage, the policies and regulations are not clear, and there may be unknown requirements for the future high-tech industry. This problem will be further studied in the future.

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Declarations

Conflict of interest The authors declare no competing interests.

References

Alharbi T, El-Sorogy A (2019) Assessment of seawater pollution of the Al-Kharrar Coastal Area, Arabian Gulf, Saudi Arabia. Environ Monit Assess 191:383. https://doi.org/10.1007/s10661-019-7505-1

Batayneh A (2010) Heavy metals in water springs of the Yarmouk Basin, North Jordan and their potentiality in health risk. International Journal of Physical Sciences 5:997–1003

Bazzi A (2014) Heavy metals in seawaters, sediments and marine organisms in the Gulf of Chbahar, Oman Sea. Journal of Oceanography and Marine Science 5(3):20–29

Diagomanlin V, Farhang M, Ghazi-Khansari M, Jafar-Zadeh N (2004) Heavy metals (Ni, Cr, Cu) in the Karoon waterway river, Iran. Toxicol Lett 151:63–68

El Sayed M (2002) Distribution and behavior of dissolved species of nitrogen and phosphorus in two coastal red sea lagoons receiving domestic sewage. Journal of King Abdulaziz University, Marine Science 13:47–73

Ghandour I, Haredy R (2019) Facies analysis and sequence stratigraphy of Al-Kharrar lagoon coastal sediments, Rabigh Area, Saudi Arabia: impact of sea-level and climate changes on coastal evolution. Arab J Sci Eng 44:505–520

Guerra R, Pasteris A, Ponti M (2009) Impact of maintenance channel dredging in a northern Adriatic coastal lagoon on effects on sediment properties, contamination and fertility. Estuar Coast Shelf Sci 85:134–142

Guieu C, Chester R, Nimmo M, Martin J, Guerzoni S, Nicolas E, Mateu J, Keyse S (1997) Atmospheric input of dissolved and particulate metals to the northeastern Mediterranean. Deep-Sea Res II Top Stud Oceans 44:655–674

Harriri M, Abu-Zied RH (2018) Factors influencing heavy metal concentrations in the bottom sediments of the Al-Kharrar Lagoon and Salmanah, eastern Red Sea coast, Saudi Arabia. Arab J Geosci 11(17):399.

Hedge L, Knott A, Johnston E (2009) Dredging related metal bioaccumulation in oysters. Mar Pollut Bull 58:832–840

Saburova R, Limb J, Stolzenbach K, Schiff K (2005) Contribution of trace metals from atmospheric deposition to storm water runoff in a small impervious urban catchment. Water Res 39:3929–3937

Shraaidah MA, Okbah MA, El-Deek MS (2004) Trace metals in the water columns of the Red Sea and the Gulf of Aqaba, Egypt. Water Air Soil Pollut 153:115–124

Touliabah HE, Elbassat RA (2017) Ecological study of the Rabigh lagoon, eastern site of the Red Sea, Saudi Arabia with special reference to Eutrophication Index. J Marine Sci Res Dev 7(242):2

Venkatramanan S, Chung S, Lee S, Park N (2014) Assessment of river water quality via environmetric multivariate statistical tools and water quality index: a case study of Nakdong river basin, Korea. Carpathian Journal of Earth and Environmental Sciences 9:125–132

Wake H (2005) Oil refineries: a review of their ecological impacts on the aquatic environment. Estuar Coast Shelf Sci 62:131–140

Youssef M, El-Sorogy A (2016) Environmental assessment of heavy metal contamination in bottom sediments of Al-Kharrar lagoon, Rabigh, Red Sea, Saudi Arabia. Arab J Geosci 9:474

Zhang J, Zhou F, Chen C, Sun X, Shi Y, Zhao H, Chen F (2018) Spatial distribution and correlation characteristics of heavy metals in the seawater, suspended particulate matter and sediments in Zhanjiang Bay, China. PLoS One 13(8):e0201414. https://doi.org/10.1371/journal.pone.0201414