Scientific Research Publishing

Open Journal of Business and Management, 2022, 10, 1549-1568
https://www.scirp.org/journal/ojbm
ISSN Online: 2329-3292
ISSN Print: 2329-3284

Research on the Evaluation Index System and Methodology for the Construction of Ecological Civilization Model Cities

—Yancheng City as an Example

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How to cite this paper: Sun, Y. Y., Chai, J., Li, W. B., & Ren, Y. H. (2022). Research on the Evaluation Index System and Methodology for the Construction of Ecological Civilization Model Cities. *Open Journal of Business and Management, 10,* 1549-1568.
https://doi.org/10.4236/ojbm.2022.103081

Received: April 22, 2022
Accepted: May 28, 2022
Published: May 31, 2022

Abstract

The structure of this article is as follows. This topic takes the construction of ecological civilization in Yancheng City as the research object, conducts a comprehensive evaluation study on the development of ecological civilization in Yancheng City, examines its main achievements in ecological civilization construction and the level of improvement under the relative mechanism, and studies the effective measures for Yancheng to become a model city of ecological civilization with high quality development. This paper firstly combs the relevant literature and examines the development status of ecological civilization in Yancheng City. Secondly, data such as energy consumption per unit of GDP, vegetation coverage and protected area are explored and analyzed to compare the indicators of Yancheng City with the top ten ecological civilization cities in China and the neighboring cities. Next, a scientific evaluation index system for the construction of ecological civilization demonstration cities is constructed, and principal component analysis, cluster analysis and time series analysis are used to comprehensively evaluate the development of ecological civilization construction in the city from 2015-2019. Finally, through the analysis of the current situation and overall situation of the development of ecological civilization industry in the city, scientific countermeasures and suggestions are proposed in combination with the requirements of high-quality development.

Keywords

Ecology, Principal Component Analysis, Cluster Analysis, Time Series Analysis

1. Introduction

1.1. Background and Significance of the Study

Ecological civilization refers to the sum of ethics, norms, principles and ways and means and results achieved in the practice of ecological economy and society by joint workers following the objective law of harmonious and coordinated development of nature, man and society, with the fundamental purpose of harmonious co-prosperity between man and nature, man and man, man and society, and man and himself, and is a socio-economic form with the basic content of achieving the comprehensive and harmonious development of the organic whole of ecological economy and society (Liu Jiangyi, 2015). Ecological civilization symbolizes the progressive state of the relationship between man and nature. Building ecological civilization and making efforts to promote green development are long-term plans for the well-being of the people and the future of the nation, laying a solid foundation for the further realization of the great rejuvenation of the Chinese nation, pointing out the direction of advancement and the path of realization for efforts to build a beautiful China, achieve the sustainable development of the Chinese nation, and move towards a new era of socialist ecological civilization.

Xi Jinping pointed out in the report of the 19th National Congress that building an ecological civilization is a thousand-year plan for the sustainable development of the Chinese nation, and that we should accelerate the reform of the ecological civilization system and build a beautiful China. Man and nature are a community of life, and man must respect nature, conform to nature, and protect nature.

As the "Wetland Capital of the East", Yancheng has the largest coastal wetlands on the west coast of the Pacific Ocean and the edge of the Asian continent, as well as vast lakes and wetlands in the Lixia River area. In recent years, Yancheng City has responded positively to national policies, coordinated the planning of special resources, carried out in-depth green ecological action, and created a double-optimal road for the coordinated development of ecology and industry. The successful practice of "two seas and two greens", which Yancheng has long insisted on "ecological city", is a major achievement of practicing Xi Jinping's thought of ecological civilization.

This project will use principal component analysis, cluster analysis and time series analysis to comprehensively evaluate the development of ecological civilization in Yancheng City, construct and improve a higher level evaluation index system for the construction of ecological civilization model city, and use this system to simulate and apply and summarize, so as to provide a more objective theoretical basis for the subsequent evaluation, and thus put forward scientific and reasonable suggestions for the high-quality development of ecological civilization.

1.2. Current Status of Relevant Research at Home and Abroad

The construction of ecological civilization has attracted widespread attention from society, and many scholars at home and abroad have conducted research

on different aspects of the ecological civilization evaluation index system.

In 1993, the Organization for Economic Cooperation and Development and the United Nations Environment Programme jointly established the "Pressure-State-Response" (PSR) model to evaluate the impact of human activities on the ecological environment (Farsari & Prastacos, 2002). Subsequently, the United Nations Commission on Sustainable Development (CSD) extended the PSR model and constructed the "Drive-State-Response" (DSR) model, and the United Nations Bureau of Statistics (UNBS) and the governments of the United Kingdom and the United States have also established their own sustainable development evaluation indices in this framework (Ahamer & Mayer, 2014; Wu & wu, 2012).

Liu Miying and Wang Jilong used an interdisciplinary comprehensive evaluation model to scientifically construct China's ecological civilization construction standards and evaluation index system based on three fields: ecological consciousness, ecological behavior, and ecological system, and divided the evaluation system into four layers according to the nature of the indexes: target layer, thematic area, evaluation theme, and specific indexes, and added some indexes that can guide or regulate the direction of ecological civilization construction from the governmental behavior level (Liu & Wang, 2016).

Zhang Qiaohua et al. proposed that the urban ecological civilization index system consists of three levels, namely, the target layer, the criterion layer and the indicator layer (Zhang Qiaohua et al., 2010). The target layer consists of one indicator of the composite system ecological civilization degree, and the criterion layer establishes the evaluation subsystem indicator system with three aspects of economic development, ecological environmental protection and social progress, and each subsystem is divided into several indicators to form 24 evaluation indicators, including 8 items of economic development subsystem, 11 items of ecological environmental protection subsystem and 5 items of social progress subsystem, which are the basis of the whole evaluation (Zhang Qiaohua et al., 2010).

In line with the research direction of many scholars, we also conducted an in-depth study on the ecological civilization evaluation index system and tried to conduct a comprehensive evaluation study on the development of ecological civilization in Yancheng City. However, we found that the previous studies seldom compare the ecological civilization construction level of several provinces and cities together, so the suggestions and countermeasures proposed are somewhat limited. In order to compare the differences between Yancheng City and the top ten ecological civilization cities in China and the neighboring cities, we propose more scientific countermeasures and suggestions to promote the construction of ecological civilization and sustainable development.

1.3. Research Content

Firstly, the research background and significance of this topic are introduced;

the current situation of domestic and foreign research on ecological civilization development is discussed by collecting relevant literature; the analysis principles of principal component analysis method and cluster analysis are explained.

Secondly, we will take the current situation of ecological civilization construction in Yancheng City as the research object, construct a comprehensive evaluation index system, and collect data about the development of ecological civilization construction in Yancheng City by using the Yancheng City Statistical Yearbook report to make a descriptive analysis of the current situation of ecological civilization development in Yancheng City.

Then, this topic will use principal component analysis to conduct a comprehensive evaluation of the development of ecological civilization construction in Yancheng City from 2015 to 2019 and establish a comprehensive score ranking; in addition to using factor analysis to reduce dimensionality and derive a comprehensive evaluation score formula for comparing the gaps between different cities, this topic also evaluates different cities through the use of cluster analysis as the main method, supplemented by time series analysis, to In addition, this project also uses cluster analysis as the main method and time series analysis as the secondary method to classify different cities and grasp the current situation of ecological civilization construction in Yancheng in recent years.

Finally, based on the above research, a comprehensive evaluation of the construction of ecological civilization in Yancheng City is conducted, and a series of targeted opinions and suggestions on the emergence of a series of problems are put forward to provide reference for the relevant departments in formulating policies and optimizing industrial structure, and to contribute to the improvement of the high-quality development of Yancheng City.

2. Analysis of the Current Situation of the Development of Ecological Civilization in Yancheng City

2.1. Longitudinal Analysis of Ecological Civilization Construction in Yancheng City in the Past Five Years

Due to the absence of data on some indicators, we adjusted the data years from 2017-2021 to 2015-2019 to facilitate the further development of the subject. This will affect the credibility of the conclusions and recommendations to a certain extent, but its impact is negligible in light of the level of ecological civilization construction in Yancheng City in recent years.

The subject members consulted the 2015-2019 Yancheng Statistical Yearbook, the official website of Yancheng Ecological Environment Bureau, and national data, etc. They mainly selected the development data of ecological civilization construction in Yancheng from 2015 to 2019, and conducted a longitudinal analysis of ecological civilization construction in Yancheng in the past five years.

First, we make a data analysis of the economic development of ecological civilization in Yancheng City from 2015 to 2019. The specific data are shown in Table 1 and Figure 1.

Table 1. Economic development of ecological civilization in Yancheng City.

Year	Disposable income per capita	Energy consumption per unit of GDP	Service industry as a percentage of regional Share of Gross Domestic Product	Engel Coefficient
2015	22,419	0.20	42%	0.31
2016	24,463	0.33	43.50%	0.32
2017	25,616	0.45	44.50%	0.32
2018	28,126	0.59	45.10%	0.81
2019	32,096	0.72	47.50%	0.78

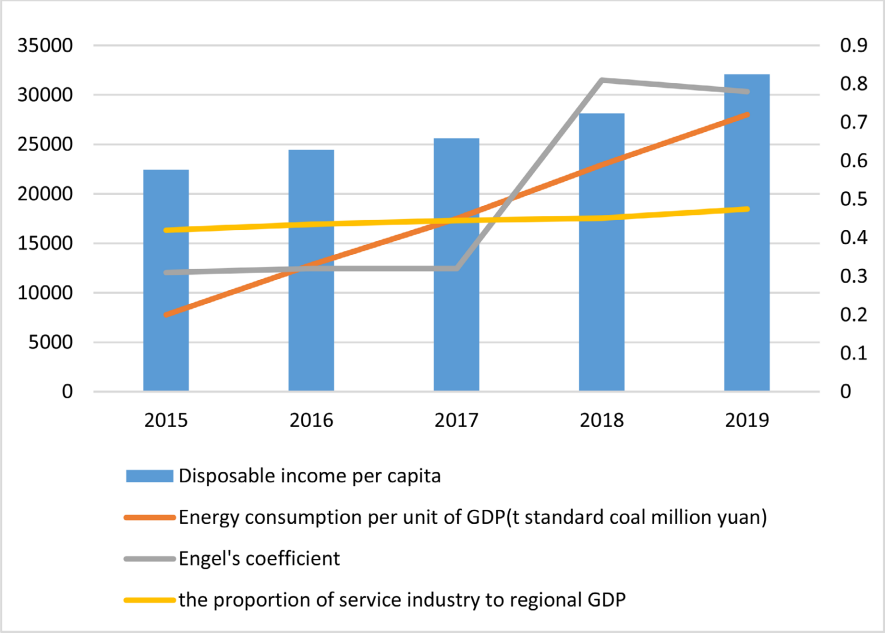

Figure 1. Schematic diagram of the change of economic development of ecological civilization in Yancheng City

As can be seen from the data in Table 1: The per capita disposable income in Yancheng City from 2015-2019 is increasing year by year, and by 2018 the per capita disposable income has reached 32,096 yuan, which is quite a considerable figure. Promoting ecological value is an effective way to promote high-quality development and increase income (Qian Chen et al., 2021), so we believe that the effect of ecological civilization in Yancheng City is not only reflected in the urban environment, but also in the economic level.

Also, the energy consumption per unit of GDP in Yancheng City from 2015-2019 increased from 0.2 tons of standard coal/yuan to 0.72 tons of standard coal/yuan, with an overall linear upward trend. The rising trend directly reflects that the reliance on energy for economic development in Yancheng City is increasing year by year, which we believe is related to the fact that the proportion of the service industry in the regional GDP is increasing year by year, and the

demand for electricity in the service industry, such as leasing, business services, housing and real estate, is increasing, but it fails to receive good attention from the city. Therefore, at this stage, the improvement of energy efficiency and optimization of energy consumption structure is still the focus of the city's ecological civilization construction.

As shown in Figure 1, the proportion of service industry to regional GDP in Yancheng City is also increasing year by year, and the proportion of service industry to regional GDP is 42% in 2015, and reaches 47.5% in 2019. At the same time, from 2015 to 2018, the proportion of service industry to regional GDP has been rising in a slow trend, but from 2018 to 2019, the growth rate of the proportion of service industry to regional GDP has fluctuated and increased rapidly. It can be seen that at this stage, Yancheng City is deeply implementing the concept of Yangtze River Delta synergistic development, changing the mode of economic growth and optimizing the industrial structure, and is accelerating the transformation of the service industry from traditional service industries such as warehousing and post and telecommunications, transportation, and catering and accommodation to modern service industries relying on high technology and modern management methods and business practices, which also fully indicates that the overall development of the service industry in Yancheng City is improving, and gradually becoming the Yancheng City's economic growth It also shows that the overall development of service industry in Yancheng is improving, and it is gradually becoming the leading industry of economic growth in Yancheng.

Then, we made a descriptive analysis of the development of ecological civilization and environment in Yancheng City from 2015 to 2019. The specific data are shown in Table 2.

By analyzing the data of vegetation cover from 2015 to 2019 in Table 2, the vegetation coverage is slowly increasing. Increasing vegetation area is an important measure to help achieve the goal of carbon peaking and carbon neutral. Yancheng City insists on establishing the orientation of ecological priority and green development, continuously increasing financial investment, strengthening scientific greening and improving greening quality.

Table 2. Development status of ecological civilization environment in Yancheng City.

Year	Vegetation cover	Visitor arrivals (million)	Number of 4a and 5a scenic spots	Popularity of eco-civilization publicity	Unemployment rate
2015	25.90%	2271	12	40.60%	1.89%
2016	26.30%	2580	12	43.20%	1.85%
2017	26.70%	2933	12	50.90%	1.82%
2018	27%	3333.9	12	53.10%	1.78%
2019	27.74%	3710.6	17	60.50%	1.78%

Through the data analysis of the visitor arrivals from 2015 to 2019, the visitor arrivals show significant growth. It can be seen that Yancheng City adheres to the concept of green and sustainable development, attracts a large number of tourists by protecting the environment and creating beautiful landscapes, vigorously promotes the development of ecological tourism, gives good play to the advantages of tourism in the construction of ecological civilization, and benefits from ecological protection. Tourism, as a typical resource-saving and environment-friendly industry, is a very advantageous industry in the construction of ecological civilization.

At the same time, the data in Table 2 show that the popularity of ecological civilization in Yancheng has been steadily increasing, which shows that Yancheng City attaches importance to raising citizens' awareness of greening and environmental protection, adhering to the policy of city-wide mobilization, giving full play to the advantages of the system, strengthening organizational guidance, enhancing endogenous motivation, and mobilizing social subjects to invest in the greening of the country.

2.2. Horizontal Analysis of Ecological Civilization Construction in Eleven Cities

Members of this project consulted the 2015-2019 statistical yearbooks of 11 cities, including Yancheng, Xuzhou, Wuxi, Qinhuangdao, and Dezhou, the official website of each city's ecological environment bureau, and national data to obtain data on the development of their ecological civilization construction according to the indicators of the established comprehensive evaluation system, and to compare the differences between the indicators of ecological civilization construction in Yancheng and the average level of the remaining ten cities. The comparative data are shown in Figure 2.

As shown in Figure 2, the area of protected areas in Yancheng City far exceeds the average of the top ten ecological civilization cities in China, which is a

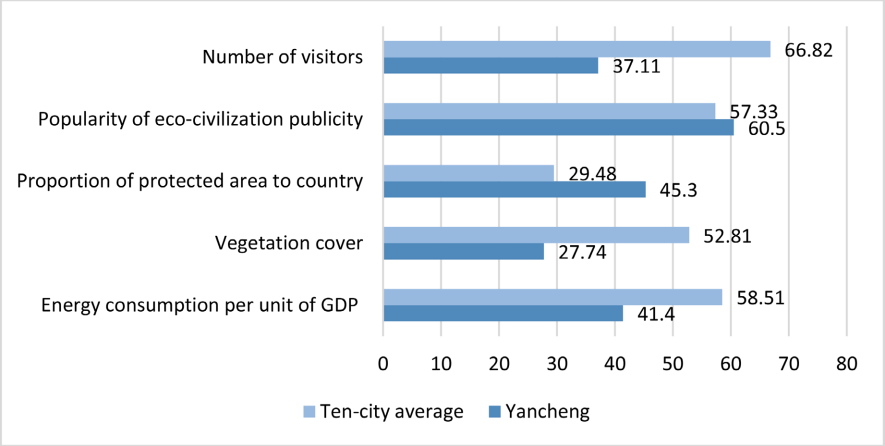

Figure 2. Differences in indicators between Yancheng City and the top ten ecological civilization cities in China.

significant advantage. The energy consumption per unit of GDP has also gradually decreased to below the average energy consumption per unit of GDP of the top ten ecological civilization cities in China. However, there are still shortcomings in the overall ecological civilization construction, for example, the number of visitors and vegetation coverage are still far from the average level of the top ten ecological civilization cities in China.

In addition, the data on the development of ecological civilization construction in Yancheng City and the neighboring cities were used to compare the differences of each index. Compared with the neighboring cities, Yancheng City is second only to Yangzhou in terms of protected area and far exceeds the neighboring cities, maintaining a clear advantage; in terms of energy consumption per unit of GDP and the popularity rate of ecological civilization propaganda, Yancheng City is not significantly different from the neighboring cities, but still in an advantageous position; in terms of vegetation coverage and visitor arrivals, Yancheng City is significantly different from the neighboring cities and in an inferior position.

3. Analysis of the Factors Influencing the Construction of Ecological Civilization

3.1. Constructing the Index System

According to the criteria of the 2017 industry classification and the principles of constructing the index system, this paper selects five representative primary indicators and 11 secondary indicator systems to construct an evaluation index system for the construction of ecological civilization demonstration cities. The data sources are indicated in Table 3. The details are shown in Table 3.

Table 3. Evaluation indicators of ecological civilization model city construction.

Indicator layer	Guideline layer	Evaluation Indicators	
Ecological civilization construction	Ecological civilization economy	GDP per capita (million yuan)	X1
		Energy consumption per unit of GDP (t standard coal/million yuan)	X2
		Service industry as a percentage of GDP	X3
		Engel's coefficient	X4
	Ecological civilization environment	Vegetation cover (%)	X5
		Number of 4a and 5a scenic spots	X6
		Proportion of protected area to country	X7
	Ecological civilization and livelihood	Unemployment rate	X8
		Visitor arrivals	X9
	Ecological Civilization Culture	Popularity of eco-civilization publicity	X10
	Ecological civilization system	Number of lawyers per million people	X11

(The data source national statistical yearbook, Yancheng City Ecological Environment Bureau official website, national data, etc.)

1) Ecological civilization economy of ecological civilization model city construction. Ecological civilization economy is mainly described from four indicators: GDP per capita (10,000 yuan), energy consumption per unit of GDP (t standard coal/10,000 yuan), the proportion of service industry to regional GDP, and Engel coefficient. The effective indicator of the development level of ecological civilization economy in a region is GDP per capita, and similarly, energy consumption per unit of GDP and other indicators are also the basic indicators to measure the level of ecological civilization economy in a region.

2) Ecological civilization environment of ecological civilization model city construction. Ecological civilization environment is mainly described from 3 indicators: vegetation coverage rate (%), the number of 4a and 5a scenic areas, and the area of protected areas as a proportion of the country. The ecological civilization environment is a comprehensive measure of the overall level of work of a regional party committee and government.

3) Ecological civilization livelihood of the construction of ecological civilization model cities. 2 indicators are mainly selected to reflect the unemployment rate and the proportion of low-income population.

4) Ecological civilization culture of ecological civilization model city construction. The ecological civilization culture in this topic is specifically described by the ecological civilization publicity and popularization rate. Strengthening the construction of ecological civilization culture is of great significance for building an ecological civilization society.

5) Ecological civilization system for the construction of ecological civilization model city. The indicator of the number of lawyers per 10,000 people is mainly chosen to reflect this.

3.2. Pre-Processing of Data

Before performing principal component analysis on the data, the z-score process was performed on the data for the purpose of transforming data of different magnitudes into a uniform measure of z-score scores for comparison. This adds precision to the results of the subsequent analysis. Indicator 2 and indicator 4 were then inverted, i.e., the data were subjected to a magnitude process to improve the data quality.

3.3. Determination and Interpretation of Principal Components

In order to make a comprehensive evaluation of the level of construction of the model city of ecological civilization in Yancheng City from 2015 to 2019, this topic uses 11 indicators established in the data to conduct a principal component analysis of the level of construction of the model city of ecological civilization in Yancheng City.

First, factor analysis was performed, and here the correlation of variables was tested using Bartlett's test and KMO test. Here Bartlett's test corresponds to a p-value of 0.069, which is closer to 0.05 and can be considered as more signifi-

cant, so we consider this data suitable for principal component analysis.

There were three values greater than 1 in the gravel plot, so we judged that a total of three principal components were extracted.

The variance explained by the first principal component, second principal component and third principal component were 34.907%, 19.55% and 12.606%, respectively, and the cumulative variance explained by 34.907%, 54.457% and 67.063%. It indicates that the three principal components are able to express 67.063% of the information content of the 11 analyzed items, and the principal component analysis is up to standard.

Then we give the loading coefficients on the three principal component factors obtained by solving the 11 evaluation indicators using principal component analysis, and the specific data are shown in Table 4.

The loading coefficients on the three principal component factors obtained by solving for the 11 evaluation indicators using principal component analysis are given in Table 4, indicating the degree of correlation between the original and composite indicators. In general, the larger the absolute value of the factor loadings, the stronger the interpretation of the vector of indicators represented.

The absolute values of the loading coefficients of the composite index F1 on X1, X2, X3, X7, X8, X9, X10 and X11 are all above 0.4, and the per capita disposable income, energy consumption per unit of GDP (t standard coal million yuan), the proportion of service industry to regional GDP, the popularity rate of ecological civilization propaganda, the number of lawyers owned by 10,000 people, the number of tourists, 4a and 5a scenic spots, and the Engel coefficient

Table 4. Principal component analysis loading coefficients

Name	Load factor		
	F1	F2	F3
Disposable income per capita	0.638	0.191	−0.21
Energy consumption per unit of GDP (t standard coal million yuan)	0.682	−0.414	0.242
Service industry as a percentage of GDP	0.612	−0.061	0.391
Vegetation cover (%)	0.197	0.655	0.527
Proportion of protected area to country	0.388	−0.665	0.003
Unemployment rate	−0.003	0.855	−0.153
Popularity of eco-civilization publicity	0.61	0.096	0.589
Number of lawyers per million people	0.8	0.29	−0.192
Number of visitors	0.672	0.358	−0.526
Number of 4a and 5a scenic spots	0.697	−0.336	−0.405
Engel's coefficient	0.675	0.048	0.081

(The blue font indicates a strong correlation between the original and composite indicators, with absolute values above 0.4).

represent the level of construction of Yancheng ecological civilization model city. And Engel's coefficients all reflect the level of construction of Yancheng City as a model city of ecological civilization, so F1 is called "Yancheng City Ecological Civilization Factor".

The absolute values of loading coefficients of composite index F2 on X2, X4, X5, X6 indicators are larger, all above 0.4, while the energy consumption per unit of GDP (t standard coal million yuan), vegetation coverage rate (%), the proportion of protected area to the country, and unemployment rate represented by these indicators reflect the degree of civilization under urban livelihood, so F2 is called "the degree of civilization under urban livelihood".

The absolute values of loading coefficients of composite index F3 on X4, X7, X9, X10 indicators are larger than 0.4, and the vegetation coverage rate (%), popularity rate of civilization propaganda, number of tourists, 4a, 5a represented by these indicators reflect the greening level of cities developing tourism, so F3 is called "greening level of tourism Greening level of cities".

In order to obtain the level of construction of ecological civilization model city in Yancheng City from 2015-2019, we define the following formula for the composite score of principal components through these three principal component variables, where y denotes the level of construction of ecological civilization model city.

$$y = 0.056x_1 + 0.046x_2 + 0.085x_3 + 0.125x_4 - 0.03x_5 + 0.064x_6 + 0.118x_7 + 0.082x_8 + 0.05x_9 - 0.004x_{10} + 0.073x_{11}$$

Here it is defined according to the comprehensive score: a positive comprehensive score indicates that the city has a high level of ecological civilization demonstration city construction, while the opposite indicates that the city has a low level of ecological civilization demonstration city construction.

Thus, we give the comprehensive scores and rankings of Yancheng City, Top 10 Civilized Cities and North Jiangsu Province from 2015-2019, as shown in Table 5.

According to Table 5, we intuitively conclude that Qingdao has the highest level of ecological civilization model city construction and better economic development, and ranks first in the overall score. Among these regions, Yancheng City has changed its comprehensive score from negative to positive in the five years from 2015 to 2019, and the level of construction of Yancheng City as a model city of ecological civilization has gradually improved, temporarily ranking eighth in 2019. It is known from the data that the per capita disposable income of Yancheng City in 2015 is low and the number of lawyers owned by ten thousand people is low, which indicates that the economic development of Yancheng City is backward and the comprehensive strength is low; the proportion of service industry in the total value of the region and the per capita disposable income have a certain correlation, that is, the level of service industry development of Yancheng City has a certain influence on its economic level. However, it can

Table 5. Overall score and ranking of Yancheng City, Top Ten Civilized Cities and North Jiangsu Province, 2015-2019.

Number	City	Rank	Overall Score
10	Qingdao	1	8.63
7	Wuxi	2	7.60
18	Yangzhou	3	4.20
11	Guiyang	4	4.13
15	Shangri-La	5	1.24
6	Xuzhou	6	0.73
16	Lianyungang	7	0.70
5	Yancheng (2019)	8	0.35
8	Qinhuangdao	9	0.15
17	Taizhou	10	-0.63
12	Liuyang	11	-1.05
4	Yancheng (2018)	12	-1.74
9	Texas	13	-1.88
13	Longyan	14	-2.81
3	Yancheng (2017)	15	-3.60
2	Yancheng (2016)	16	-4.80
14	Zhongshan	17	-5.53
1	Yancheng (2015)	18	-5.67

(Numbers 1 - 18 correspond to the cities on the right, respectively).

be seen that the area of protected areas in Yancheng City accounts for a relatively significant proportion of the country and the number of 4a and 5a scenic areas in the city. We can consider focusing on the development of modern service industry, giving full play to the location and environmental advantages of Yancheng City, clarifying the positioning of the city, and increasing the publicity and popularization of ecological civilization.

In comparison, the energy consumption index value per unit of GDP in Yancheng is lower than that of Qinhuangdao, which shows that Yancheng has a high utilization rate of resources and a high awareness of environmental protection among residents, enterprises and the government. We can consider developing energy-saving and environmental protection enterprises, with "foresight, innovation, and practicality" as the guideline, and aspire to develop many energy-saving and environmental protection enterprises.

Among the six cities in northern Jiangsu, Yancheng and Lianyungang are the closest in ranking, so it is obvious that the popularity of eco-civilization in Lianyungang is higher than that of Yancheng. We can consider increasing the pub-

licity of eco-civilization construction, making articles on highlighting the characteristics of water and greenery, shaping the image of the city, making efforts on strengthening environmental improvement and improving the quality of human living, and making efforts on strengthening education and guidance, cultivating eco-culture.

3.4. Cluster Analysis

After giving the comprehensive scores and rankings of Yancheng city, the top ten civilized cities and northern Jiangsu region from 2015 to 2019, we wanted to conduct a cluster analysis of these cities to try to explore which cities have similar levels of ecological civilization model city construction. Therefore, we use SPSS to perform hierarchical clustering of the data and give the corresponding spectrum diagram, as shown in Figure 3.

From the spectrum chart, we know that Yancheng (2015), Yancheng (2016) and Yancheng (2017) are divided into the same category, and Yancheng (2018) and Yancheng (2019) are divided into the same category with Xuzhou, Huaizhou and Lianyungang. Here Xuzhou, Huizhou, Lianyungang and other 13 regions are

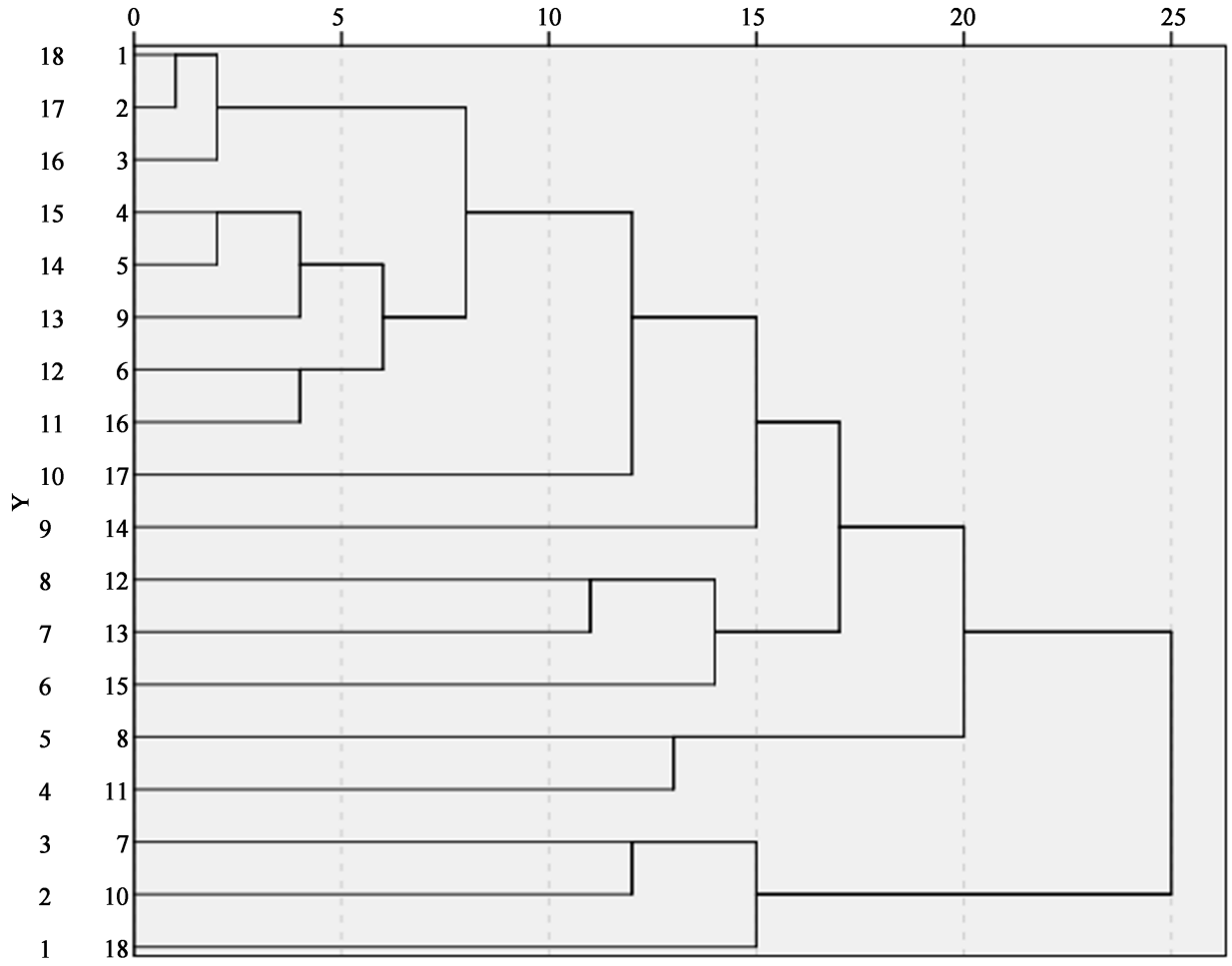

Figure 3. The spectrum chart.

given the data of 2015, so we can get: the development of Yancheng in 2018-2019 is closer to that of Xuzhou, Huizhou and Lianyungang in the latter years. If readers would like to further explore the level of construction of the model city of ecological civilization, they can refer to the development level of Xuzhou, Huizhou and Lianyungang in the latter years. This topic draws on some initiatives made by the three cities in the construction of the model city of ecological civilization and further plans the requirements for the construction of the model city of ecological civilization in Yancheng specifically.

Mayor Fang Wei of Lianyungang said in his speech that during the 13th Five-Year Plan period, the city insisted on ecological priority and green development, grasped environmental problems and rectification with determination, resolutely fought the battle of pollution prevention and control, and continuously improved the quality of development and environmental quality, and made breakthrough progress in ecological civilization construction. Yancheng City Bureau of Ecology and Environment can consider focusing on the "carbon peak, carbon neutral" requirements, in-depth research on low-carbon development and carbon peak top-level design, vigorously promote industrial restructuring, comprehensively reduce non-electricity coal, deepen energy reduction and efficiency and other key work, and effectively take the road of green low-carbon development.

3.5. Forecast on the Level of Ecological Civilization in Yancheng City in the Next Few Years

Through the above principal component analysis and cluster analysis, we can see that the level of construction of ecological civilization demonstration city in Yancheng City has been growing year by year, with reference to the development plans of Xuzhou, Huizhou and Lianyungang.

We consider Yancheng City to put more effort on indicators such as energy consumption per unit of GDP (t standard coal million yuan), vegetation coverage (%), and the proportion of service industry in regional GDP; the city continues to accelerate the transformation of economic growth, increase regulation and control, increase the share of high-tech industries, and further optimize the industrial structure.

Yin Jie et al. proposed that most high-tech industries in China have low innovation efficiency in the assimilation stage, growth stage and utilization stage, and there are large differences between different industries (Yin Jie et al., 2020). Therefore, the government should vigorously develop new industries with high technological content and high value-added products, and gradually reduce the dependence of the city's economic development on energy; give priority to native trees, precious timber and colorful species for afforestation, scientifically design greening configuration patterns that are easy to manage and maintain and simple, and comprehensively increase the overall green volume of villages, improve the greening taste and beautification level; adapt to the new situation of

new industrialization and the upgrading of residents' consumption structure, focus on developing modern service industries, standardize and upgrade traditional service industries, give full play to the role of service industries in absorbing employment, optimize the industry structure, upgrade the technical structure, improve the organizational structure, and comprehensively improve the development level of service industries.

This predicts that the level of construction of Yancheng City as a model city of ecological civilization can reach a higher level.

4. Conclusion and Recommendations

Through the above clustering analysis, we understand that the development of Yancheng in 2018-2019 is closer to that of Xuzhou, Huizhou and Lianyungang in the latter years. If the reader would like to further explore the level of construction of ecological civilization model cities, they can refer to the development level of Xuzhou, Huizhou and Lianyungang in the latter years. In other words, some of the development suggestions presented below are also applicable to the future development of Xuzhou, Huizhou and Lianyungang, and can be used for reference and initial piloting in the three cities. In this regard, this topic further focuses on the conclusions of the analysis, combined with the characteristics of local economic development, to explore some of the following development proposals.

4.1. Systematic Planning of Ecological Environment Protection and Management

Yancheng City is located on the shore of the Yellow Sea, one of the few original coastal zones in the country and even in the world, the most complete type of coastal wetland ecosystem in China, as the only coastal wetland world natural heritage site, rich in wetland resources. In recent years, the government has taken ecological development as the driving force, insisted on planning first, and built a wetland protection management system by introducing local regulations, increasing financial investment, and rational use of resources, etc. The natural wetland protection rate reached 61.8%. Yancheng wetlands are also facing problems such as ecological degradation and ecological invasion in some areas. In response to the problems, the government has proposed the scientific implementation of ecological restoration, improve ecological compensation, emergency warning mechanism, and promote ecological and economic coordination of development measures.

Yancheng City deeply practices the development concept of "green water and green mountain is the silver mountain of gold", improves the political standing, strengthens the system management, comprehensive management, source management. Take advantage of ecological resources. In view of the current problems, the government should continue to strengthen the protection of wetlands, grasp the ecological protection and restoration, in order to promote the ecologi-

cal protection of wetlands in Yancheng City, change the traditional development thinking and governance model to provide a guarantee. At the same time, it can amplify the advantages of resources, promote sustainable development, integrate the ecological service functions of wetlands with leisure tourism, cultural promotion and agriculture, and carry out sustainable utilization of wetland resources, such as the regular Danting Crane Flight Exhibition, winter bird watching and photography, and two-day and one-night study camps in the Rare Bird Sanctuary. The coastal wetlands are rich in reeds, seafood, shipping and wind power resources, and the Dantoo Crane Sanctuary and surrounding communities alone produce a million quintals of reeds and export nearly 300 tons of sandworms annually. The rational use of wetland resources is conducive to maintaining the development of a virtuous cycle of wetlands and the regional economy. In addition, scientific planning and promoting wetland restoration projects are also important measures to promote the construction of ecological civilization. The government can invest more funds to carry out projects such as restoration of degraded wetlands, water diversion and alkaline conversion, and ecological compensation for wetlands. In short, Yancheng City can carry out targeted protection work in terms of ecological environmental protection, effectively strengthen the management of nature reserves, and solve the outstanding ecological environment problems in Yancheng City, adhere to sustainable development, and promote the high-quality development of ecological civilization construction.

4.2. Optimize Industrial Structure and Improve Energy Use Efficiency

Since the reform and opening up, Yancheng City has adopted a rough and loose approach to promote economic development, so it is difficult to achieve sustainable economic development. Yancheng City's economy as a whole is in a period of rapid development, driving high growth in energy demand. To maintain sufficient momentum, it has become inevitable to accelerate the transformation from a crude to an intensive mode of economic growth. Considering the reality that Yancheng City will certainly be in energy consumption along with economic growth in the future for some time, first of all, the government should change the mode of economic growth and optimize the industrial structure, accelerate the development of tertiary industries, especially modern service industries, and control high energy-consuming industries, for example, for high energy-consuming industries such as automobiles, the government can strengthen the research and development investment in energy-saving technology transformation, promote enterprises to carry out real energy-saving emission reduction and energy-saving technology upgrade, and guide their industrial structure to upgrade continuously.

Second, vigorously develop high-tech industries, increase the proportion of high-tech industries in industrial value added, increase their investment in re-

search and development, and vigorously promote technology-based, resource-saving, and high-efficiency production methods. Also rely on management innovation as well as conceptual innovation, etc. to drive the energy saving and emission reduction of the industries they are in, and use financial incentives and taxation to encourage the development of low-pollution, low-consumption industrial layout, and also provide economic returns for industries to develop energy-saving technologies.

Wu Xiaoyan said that the 14th Five-Year Plan period will strictly control the growth of coal power projects, coal consumption, no new overseas coal power projects, to take practical action to build a community of life for people and nature to contribute to China's power, to show China's responsibility to play (Wu Xiaoyan, 2022). Yancheng City naturally should follow the national policy, clean up and correct the regional preferential policies on resource prices for high energy consumption, high pollution and other industries, strict implementation of export tax rebates, import tariffs and other policies, part of the high energy consumption processing trade in the prohibited projects.

Under the dual goals of total energy consumption constraint and environmental requirements to control carbon emissions, the change of industrial structure to promote the change of energy consumption structure, reduce total energy consumption, improve energy use efficiency, while reducing coal consumption, developing clean energy and adjusting energy consumption structure are effective measures. Data show that in recent years, the proportion of coal consumption has fallen year by year, indicating that the restructuring of energy consumption in Yancheng City and total control has begun to bear fruit. Clean energy includes nuclear energy and "renewable energy", in addition to hydropower development, vigorously develop biomass energy, wind power, geothermal energy, solar energy, ocean energy and other renewable energy, clean coal research and development technology to enhance the level of clean energy consumption ratio. The level of economic development, economic growth goals, resource endowment level and geographical location advantages of different regions of Yancheng City determine the spatial variability of energy consumption, therefore, on the basis of considering the economic development of each region, formulate appropriate and precise regional policies to coordinate economic growth and energy consumption, and coordinate the common healthy development of the three regions in order to achieve the expected results. At the same time, the government should ensure the long-term mechanism of energy-related policies and management in the city, regulate the energy management and policy formulation in China through relevant legislation and other work, ensure the unity and consistency of energy management policies, and form a long-term mechanism of energy management. In the energy structure adjustment, through the development of relevant standards to regulate and measure the development and application of new energy sources and energy saving and efficiency of traditional energy sources, through the standard regulation so as to guide the development

of energy industry and achieve the optimization and adjustment of industrial structure.

4.3. Strengthen Scientific and Technological Research and Cultivate and Attract Professional Talents

Technological progress, as one of the most important factors of innovation incentives, is considered to be the key reason affecting the optimization of industrial structure. Combined with the current regional economic characteristics of Yancheng and the current situation of ecological civilization construction, the proportion of high-tech output value in industrial value added is still low, which also stems from the lagging technological transformation and lack of innovative technology use and weak technological progress. In response to these problems, first, the government can use science and technology research and development techniques to vigorously develop new energy sources and thus replace traditional energy sources, as well as develop clean renewable energy sources aimed at replacing and reducing the consumption of coal and transforming the energy consumption structure so as to reduce the total energy consumption. Second, strengthen technological transformation in the production process of energy saving and production of energy-saving products, strengthen the production process of energy-saving technology research and development and innovation, increase more energy-saving products, and gradually reduce the total energy consumption, while increasing the effective investment of R&D funds for energy-saving technology transformation, promote technological progress, and effectively curb the growth rate of total energy consumption. Finally, encourage enterprises to increase investment in research and development for comprehensive utilization of clean energy, establish a long-term effective incentive mechanism for scientific and technological innovation, allow more enterprises and individuals to participate in the ranks of technological innovation in energy conservation and emission reduction, and promote the concept of comprehensive ecological energy conservation and publicity, so that green development, energy conservation and emission reduction, and ecological priority are deeply rooted in people's hearts.

"The 14th Five-Year Plan and proposals" propose to deepen the reform of the institutional mechanism of talent development, cultivate and introduce talents in all aspects, create more international first-class scientific and technological leaders and innovation teams, and cultivate a reserve army of young talents with international competitiveness (Chen Dan & Zheng Ze-van, 2022). It is clear from the history of ecological civilization development that talents with professional knowledge are indispensable and important influencing factors, and the adoption of an intensive economic and high-quality development approach urgently requires talents with professional education and training and rich experience. To address these issues, first of all, the government can adopt targeted relevant training to cultivate highly qualified and capable reserve talents, while imple-

menting preferential policies to attract highly educated professionals and developing incentive policies for the cultivation of the introduced talents.

Second, the government can build a platform for cooperation and exchange between universities and energy-saving and environmental protection enterprises, actively encourage schools and enterprises to establish practical training and internship bases in enterprises, train professionals in the environmental industry and new energy industry needed for the development of ecological civilization construction, and further train management, skilled personnel and scientific research talents through school-enterprise cooperation, so as to fill the shortage of talents in the development of ecological civilization construction in Yancheng In order to promote sustainable development. Finally, the rational use of talent is to achieve the optimal allocation of resources, so that they can play the maximum role, and better contribute to social development. With the support of advanced technology and professional talents, the transformation and upgrading of Yancheng's economy and industry and the development of ecological civilization will move forward steadily.

Funding

Funding Information: Wanbin li, National Social Science Foundation Committee, Item Number: 17BTJ026, General projects of National Social Science Fund.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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