Measurement Of Urban-Rural Integration and Analysis of Barrier Factors in the Yangtze River Delta

Yingying Hua[1]*, Yaying Xu[1]

[1] Jiangsu University, Zhenjiang, Jiangsu, P.R. China
* Yingying Hua, School of Management Science, Jiangsu University, 301 Xuefu Road, Zhenjiang, Jiangsu 212013, P.R. China.

DOI: https://doi.org/10.56293/IJMSSSR.2022.4721

IJMSSSR 2023
VOLUME 5
ISSUE 5 SEPTEMBER – OCTOBER **ISSN: 2582 - 0265**

Abstract: A indicate system, which includes three subsystems of urban-rural economic, social and ecological integration, is constructed to assess the development level of urban-rural integration in 16 core cities in the Yangtze River Delta from 2006 to 2021 through the entropy method, in order to analyze their spatiotemporal evolution characteristics, and explore the main barrier factors hindering the development of urban-rural integration. The results showed that the development level of subsystem had greatly improved, eventually forming the regional distribution characteristic of "Shanghai>Jiangsu>Zhejiang" and the spatial distribution pattern of " high in the north and low in the south". Industrial structure, spatial connection and environmental treatment were the main barrier layers of urban-rural ESE integration, and ratio of primary industry employment to secondary and tertiary industry employment, land urbanization rate, comprehensive utilization rate of livestock and poultry manure, and ratio of villages handling domestic waste were its main barrier factors.

Keywords: urban-rural integration; barrier factors; Yangtze River Delta

1. Introduction

The urban-rural relationship is essential in the development process of modern society. There are both differences in social division of labor and geographical spatial distance between urban and rural areas, but they also have an inseparable internal correlation, which become increasingly close with the increasing the flow of development factors. Due to various reasons such as economic foundation and development process, China's urban-rural development is imbalanced. The early model of sacrificing rural areas and prioritizing cities has brought about rapid economic progress, further widening the urban-rural economic gap, causing social problems such as poor living conditions and infrastructure construction for rural residents (Fan, Zhao, & Guo, 2022). At the same time, the continuous urban expansion and excessive resource consumption have also led to environmental pollution (Hou, 2021) and ecological degradation (Al-Mulali & Ozturk, 2015). Therefore, city and countryside are not separate territorial systems, and their integration in economic, social, and ecological aspects is also interactive. Clarifying the coordinated development level and evolution characteristics among the three is crucial for promoting sustainable regional development.

The research on urban-rural integration can be roughly divided into two types of themes, one is the analysis of the theoretical connotation development and policy practice path of urban-rural integration from the perspectives of political science and administrative science. They believe that urban-rural integration is the ideal goal of urban-rural relations development, and emphasizes the flow and sharing of multi-dimensional elements such as population, space, and capital, to achieve common prosperity (Han & Wu, 2020). Therefore, the connotation of urban-rural integration is defined as a new type of urban-rural relationship that promotes mutual promotion between industry and agriculture, and complements urban and rural areas. It advocates the use of cities to drive rural areas and work to supplement agriculture, stimulating the free flow and equal exchange of urban-rural factors while promoting rapid urban development (Jin, 2019). Another thread is the comprehensive evaluation of urban-rural integration level from the perspectives of management and economics. They analyzed urban-rural spatiotemporal changes and drivers through appraising their integration level according to the qualitative indexes

from multiple dimensions such as economy, ecology, population, space or society (Shi, Duan, & Wu, 2022), which were processed by the method of subjective assessment (Zhang & Shao, 2022) or objective assessment (Lu, Gao, & Liu, 2021), and explored the influence mechanism with the model of geographic detector (Zhang, He, & Li, 2020) or spatial econometrics (Liao, Wang, & Yang, 2019). However, the focus of the above studies remains on a kind of integration centered on economy and based on material abundance, lacking the concern for social life and ecological environment, which hinders urban-rural harmonious and positive evolution.

As the forefront of reform, the Yangtze River Delta (YRD) region continues to explore typical paradigms of urban-rural integration and carries out multiple national pioneering practices. However, with the expansion of the planning and construction scope and the rise and fall of the region caused by the free flow of resource elements, the heterogeneity of urban-rural development in the YRD region has become increasingly significant, demonstrating the characteristics and evolution patterns of urban-rural development integration at different development stages and levels of urbanization. Therefore, this research establishes an assessment index framework for urban-rural integration in the YRD region, which encompasses three interrelated subsystems, namely, economic, social, and ecological integration, measures the development level of the three subsystems from 2005 to 2020 to explore its evolutionary characteristics, and summaries the factors affecting the urban-rural integration through the obstacles.

2. Materials and Methods

2.1 Research Object and Data Sources

In 2003, the YRD Urban Economic Coordination Conference first clarified the concept of the YRD Economic Circle, which is mainly composed of sixteen core cities, including Shanghai, the eight cities of Nanjing, Suzhou, Wuxi, Changzhou, Zhenjiang, Yangzhou, Nantong, and Taizhou in Jiangsu Province, and the seven cities of Hangzhou, Huzhou, Jiaxing, Ningbo, Zhoushan, Shaoxing, and Taizhou in Zhejiang Province. Therefore, the main data of this article comes from the statistical yearbooks of these cities, as well as the "China Rural Statistical Yearbook", "China Population and Employment Statistical Yearbook", "China Urban Rural Statistical Yearbook", and "China Education Statistical Yearbook".

2.2 Theoretical Framework

2.2.1 Urban-Rural ESE System

In the compound ecological systems theory, economy, society, and ecology (ESE) are three development systems with different attributes and mutual constraints (Dong & Han, 2021). The theory was usually used to study regional coordinated development (Zeng, Duan, Zhang, & Wang, 2008), urban planning (Sun & Zeng, 2013) and economic healthy development (Chen, 2020). The urban-rural system is complex and diverse, and the economic, social, and ecological subsystems are crucial for promoting sustainable development in both urban and rural areas. Therefore, from the perspective of connotation attributes, urban-rural integration requires the integrated development of multi-level fields from economy, society to natural environment. Based on this, urban-rural integration development system can be further divided into three subsystems: urban-rural economic integration, urban-rural social integration, and urban-rural ecological integration, as shown in Figure 1. Urban-rural economic integration subsystem is the material foundation for promoting the shared prosperity. It provides financial support for the construction of social and ecological facilities, public service supply, and environmental protection, meeting the survival and enjoyment needs of residents. However, the imbalance of urban and rural economy is bound to evolve into inequality in residents' social living conditions, and production activities inevitably result in resource depletion and industrial pollution, which has a negative impact on the social and ecological subsystems. Urban-rural social integration subsystem shows value orientation and target of development. It opens up the channel of “city-driving-countryside”, drives the upgrading of social demand, stimulates the optimization of economic structure, injects vitality into rural economic development, and also exacerbates the outflow of rural labor and resources. And although ecological governance receives personnel and technical support, domestic pollutants are also discharged in large quantities. Urban-rural ecological integration subsystem is the ideal pursuit of a higher level of living standard for modern residents and an environmental guarantee to promote long-term, balanced development. It provides essential production materials for economic construction and a high-quality living environment for urban and rural residents, while its existence also constrains the economic and social subsystems.

In short, the three subsystems of the urban-rural ESE system all have a certain promoting or constraining effect on each other, so their individual development level has a significant impact on the achievement of overall goals. It is not advisable to prioritize or sacrifice either one's development. Only by achieving a harmonious and consistent overall effect can the sustainable operation of the urban-rural composite system be achieved.

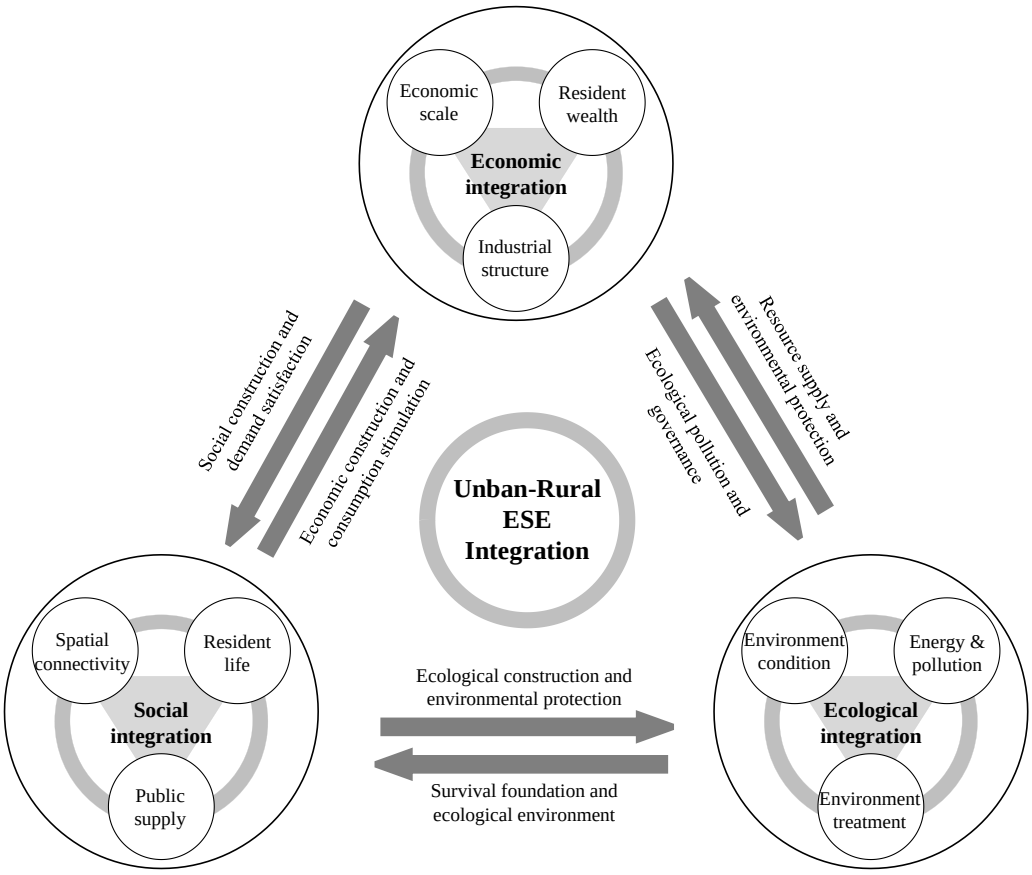

Figure 1: Urban-rural ESE system

2.2.2 Index system

The appraisal framework for urban-rural integration in the YRD region is shown in Table 1, which includes three subsystems: economic integration, social integration and ecological integration. Considering the scientific, comprehensive, and accessible nature of the data, a total of 30 indicators (X1-X30) were selected.

Urban-rural economic integration subsystem includes economic scale, resident wealth and industrial structure. Regional economic aggregate (X1) reflects economic production scale, and fixed asset (X2) reflects economic construction scale. The gap of income, consumption and its structure between urban and rural residents (X3, X5, X4) reflects urban-rural economic differences through residents' wealth. In addition, the structure of industry and employment (X6, X7, X8) reflects to some extent the rationality of economic structure, while the level of rural industrial upgrading (X9) and agricultural modernization (X10) are also important.

Urban-rural social integration subsystem includes spatial connectivity, resident life and public supply. The spatial connectivity is the foundation for achieving social integration, including urbanization of population and land (X11, X12), as well as the construction of transportation and network communication (X13, X14). The main consumer expenditure ratio (X15, X16, X17) and the supply of basic public services (X18, X19, X20) intuitively reflect the social living standards of urban and rural areas from the dimensions of transportation, healthcare, education, and social security.

Urban-rural ecological integration subsystem includes environment condition, energy and pollution and environment treatment. Environment condition is mainly reflected by greening level (X21, X22), indicating the

quality of ecological construction. The ecological status is mainly measured by the level of energy conservation and emission reduction, including coal consumption (X23), industrial wastewater and exhaust emissions (X25, X26), agricultural fertilizer application (X24), and pollution treatment level of cities and villages (X27, X28, X29, X30).

Table 1: Appraisal framework for urban-rural integration

Subsystem	Criterion layer	Index layer	Weight
Urban-rural economic integration (A)	Economic scale (A1)	GDP per capita (X1)/yuan	0.092
		Social fixed assets investment per capita (X2) /yuan	0.113
	Resident wealth (A2)	Ratio of urban and rural per capita disposable income (X3)*/%	0.022
		Ratio of urban and rural per capita consumption (X4)*/%	0.041
		Ratio of urban and rural Engel's coefficient (X5)/%	0.026
	Industrial structure (A3)	Ratio of secondary and tertiary industry output value (X6)/ %	0.024
		Ratio of primary industry employment to secondary and tertiary industry employment (X7)/%	0.426
		Ratio of rural non agricultural, forestry, animal husbandry and fi shery employees (X8)/%	0.018
		Ratio of agricultural processing industry output value (X9)/%	0.147
		Agricultural machinery power per capita (X10)/kW	0.090
Urban-rural social integration (B)	Spatial connectivity (B1)	Population urbanization rate (X11)/%	0.110
		Land urbanization rate (X12)/%	0.343
		Road network density (X13)/km/km^2	0.064
	Resident life (B2)	Internet penetration rate (X14)/%	0.160
		Ratio of urban and rural expenditure on transportation and communication (X15)*/%	0.029
		Ratio of urban and rural expenditure on culture, education and entertainment (X16)*/%	0.034
		Ratio of urban and rural expenditure on healthcare (X17)*/%	0.024
	Public supply (B3)	Ratio of faculty-to-student in general primary and secondary schools (X18)/%	0.100
		Number of health technicians per 10,000 people (X19)/person	0.027
		Urban and rural basic pension insurance coverage (X20)/%	0.108
Urban-rural ecological integration (C)	Environment condition (C1)	Green coverage rate (X21)/%	0.019
		Parkland green area per capita (X22)/m^2	0.169
	Energy and pollution (C2)	Coal energy consumption rate per unit GDP (X23)*/t/yuan	0.058
		Application amount of chemical fertilizers per unit sown area (X24)*/t/hm^2	0.093
		Industrial wastewater discharge per unit GDP (X25)*/t/yuan	0.039
		Industrial SO_2 emissions per unit of GDP (X26)*/t/yuan	0.066
	Environment treatment (C3)	Comprehensive utilization rate of solid waste (X27)/%	0.033
		Centralized treatment rate of sewage (X28)/%	0.039
		Comprehensive utilization rate of livestock and poultry manure (X29)/%	0.239
		Ratio of villages handling domestic waste (X30)/%	0.248

Note: (1) X6 = Main business income of agricultural product processing enterprises/Total output value of the

primary industry. (2) "*" indicates that the index attribute is negative. (3) Index weight was calculated through the entropy method.

2.3. Research Methods

2.3.1. Entropy method

This article refers to previous research and selects the entropy method, a commonly used objective weighting method, to calculate the development level of urban-rural integration. It can avoid the randomness during weighting and the problem of information overlap between various indicator variables (Guan, 2022).

Step 1: Standardize the data.

Positive index: $X_{ij} = v_{ij} - \min(v_j) / \max(v_j) - \min(v_j)$ (1)

Negative index: $X_{ij} = \max(v_j) - v_{ij} / \max(v_j) - \min(v_j)$ (2)

Step 2: Calculate the weight of each index.

$$y_{ij} = \frac{X_{ij}}{\sum_{i=1}^{n} X_{ij}} \quad (3)$$

$$e_j = -\frac{1}{\ln n} \sum_{i=1}^{n} y_{ij} \ln y_{ij} \quad (4)$$

$$g_j = 1 - e_j \quad (5)$$

$$w_j = \frac{g_j}{\sum_{j=1}^{m} g_j} \quad (6)$$

Step 3: Calculate the comprehensive score.

$$F_{ij} = \sum_{j=1}^{m} w_j X_{ij} \quad (7)$$

2.3.2. Barrier degree model

The obstacle degree model reflects the negative impact intensity of each indicator on the overall system by calculating the obstacle degree of each indicator. By identifying key barrier factors, it clarifies the shortcomings and shortcomings in the urban-rural integration in the YRD region (Shi, He, & Peng, 2023).

$$M_j = w_j \times R_{ik} \quad (8)$$

$$I_{ij} = 1 - X_{ij} \quad (9)$$

$$O_{ij} = \frac{M_j \times I_{ij}}{\sum_{j=1}^{m} M_j \times I_{ij}} \times 100\% \quad (10)$$

3. Results

3.1 Analysis for the development level of urban-rural integration

3.1.1 Time series evolution characteristics

The comprehensive score calculated by the weights in Table 1 and formula (7) steadily increased from 0.2656 to 0.4625, with an increase of 74.13%. From Figure 2 (a), it could be seen that the score lines for economic integration of Shanghai and Zhejiang were relatively stable from 2005 to 2013, and then began to show significant fluctuations. The reason may be that the proposal of the "Beautiful Countryside" goal prompted the region to pay attention to rural construction, achieving a significant improvement of economic integration in a short period of time. After reaching a certain peak, it began to decline again, until the "Rural Revitalization" strategy was proposed in 2017, which once again drove its score increase, entering a new round of ups and downs. The score of economic integration in Jiangsu changed relatively little, but it also showed a trend of first decreasing and then

increasing with 2013 as the time node. From Figure 2 (b), it can be seen that the social integration lines of the three regions showed a fluctuating upward trend, with Shanghai taking a significant advantage and Jiangsu having slightly better social integration than Zhejiang. Based on Figure 2 (a), it is found that the "rural revitalization" strategy also had a strong driving force for social integration in Shanghai. However, due to the lag in the investment and use of public facilities, the social integration score of Jiangsu only saw a significant increase in 2015. Figure 2 (c) shows that the ecological integration development trend in the three regions is good, showing a stable growth trend overall, with both ups and downs controlled within a reasonable range. This proves that the relevant measures for environmental protection and governance had been effectively implemented in the YRD, and the relevant concepts of ecological civilization construction and the requirements of "civilized rural style and clean village appearance" in the new rural areas were gradually deeply rooted in people's hearts.

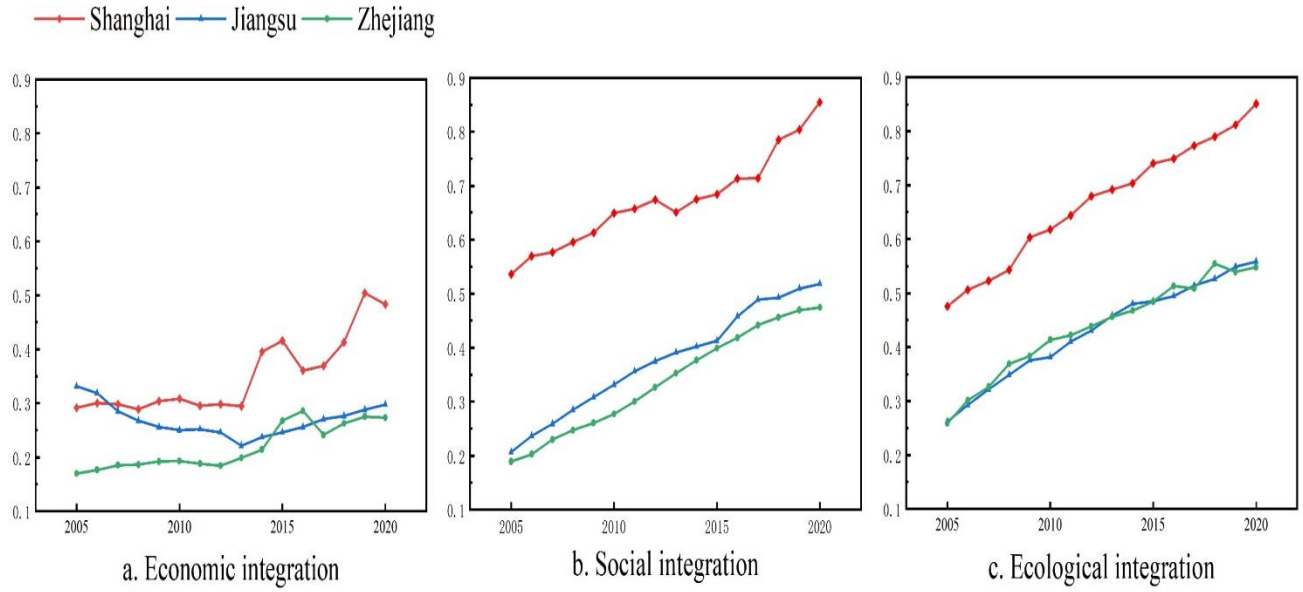

Figure 2: Time series evolution of the development level of urban-rural ESE integration

3.1.2. Spatial pattern evolution characteristics

According to the natural discontinuity method, the comprehensive scores of 2005, 2010, 2015, and 2020 were divided into four categories, as shown in Figure 3. Overall, the development level of urban-rural integration in the YRD region presents a distribution pattern of "high in the north and low in the south". On the one hand, dark colored areas represent high-level areas, namely third and fourth level areas. They are mainly concentrated in the central and northern regions of the YRD region, represented in Nanjing and Wuxi in the southern part of Jiangsu, as well as Shanghai. This type of region is formed with the central big city as the development pole, effectively integrating and driving the development of surrounding cities and rural areas, creating good integrated development conditions such as regional urban-rural connectivity infrastructure and integrated public services. Thanks to the developed economic, industrial resources, and factor diffusion functions within the metropolitan area, rural areas in these areas have also obtained good development opportunities, and the urban-rural gap is relatively small. In addition, the local government also attaches great importance to promoting the synchronous planning and investment in the construction of the urban and rural economy, society, and ecological environment in the jurisdiction, which is conducive to the improvement of the development level of urban-rural ESE integration. On the other hand, light colored areas are represented as low-level areas, namely the first and second level areas, mostly distributed at the north and south ends of the YRD region and some parts of northern Zhejiang. The common characteristic of these regions is that they are far away from central big cities, making it difficult to be included in the core metropolitan area and receive development radiation. Most of them are based on regional small and medium-sized cities, which not only have weak economic strength, insufficient development foundation and capacity, but also have poor driving power for rural areas. They are also susceptible to the siphon effect of surrounding big cities, leading to serious outflow of funds, talents, and labor factors within the region. The overall development capacity of each urban-rural subsystem is not strong.

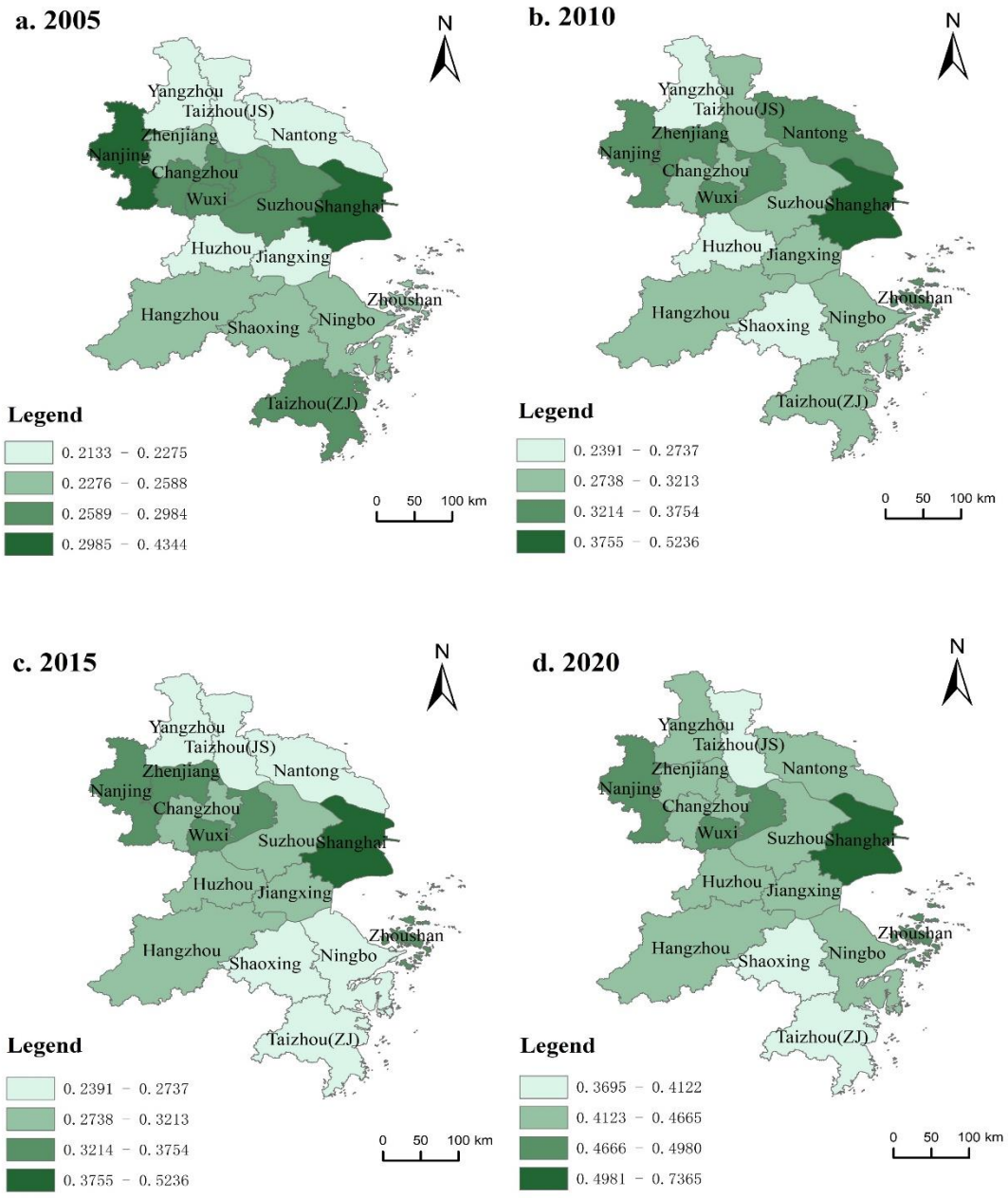

Figure 3: Spatial pattern evolution of the development level of urban-rural ESE integration

3.3 Analysis for the obstacle factors of the coupling coordination degree of urban-rural ESE integration system

The barrier degree of each standard layer (A1-C3) was calculated according to formulas (7) - (10), and took the average values of 2005, 2010, 2015, and 2020 to draw Figure 4. The industrial structure (A3), spatial connection (B1), and environmental treatment (C3) were very prominent, with an average of 25.76%, 24.46%, and 23.51%, respectively. All three were based on 2010 and 2015 as nodes, with a trend of first decreasing and then increasing. The reason may be that the policy practices in the early stages of urban-rural integration had prompted society to put forward higher requirements for industrial upgrading, urban-rural communication and pollution control to match the progress of the new round of urban-rural work. It can be seen that there is a long way to go to achieve the urban-rural ESE integration.

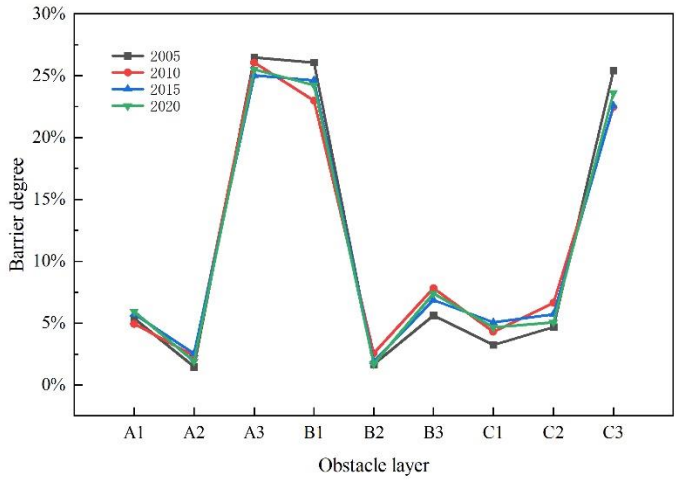

Figure 4: Barrier degree of obstacle layers

From Table 2, it can be found that the top four barrier factors were basically stable, namely ratio of primary industry employment to secondary and tertiary industry employment (X7), land urbanization rate (X12), comprehensive utilization rate of livestock and poultry manure (X29), and ratio of villages handling domestic waste (X30). Among them, the barrier degrees of X7 and X12 were greater than those of X29 and X30. The X7 reflects the allocation of human resources in the industry. The large number of employed personnel in agriculture and traditional service industries will lead to the employment structure staying at the low level, making it difficult to generate new market demand, driving down economic growth rate and hindering rural industrial upgrading, which is not conducive to rural modernization construction. The shortage of X12 not only creates obstacles to the production and life of rural migrant populations, but also brings obstacles to the construction of modern infrastructure. The X29 and X30 reflect the level of environmental governance in rural areas. Due to the strong ecological awareness in the YRD, the pollutants and waste from industrial production had reached a relatively mature level, while the level of environmental improvement in rural areas varied greatly, becoming another obstacle to promoting urban-rural integration.

Table 2: Barrier degree of the obstacle factors

长三角	2005	2010	2015	2020	均值
X1	1.35	2.78	2.48	1.72	2.08
X2	4.04	2.17	3.27	4.20	3.42
X3	0.33	0.43	0.47	0.69	0.48
X4	0.63	0.92	1.33	0.75	0.91
X5	0.51	0.98	0.74	0.48	0.68
X6	0.35	0.60	0.45	0.35	0.44
X7	17.49	16.40	16.20	17.15	16.81
X8	0.26	0.56	0.62	0.51	0.49
X9	5.40	5.13	4.77	4.82	5.03
X10	2.96	3.37	2.99	2.66	2.99
X11	2.39	3.89	3.91	3.02	3.30
X12	17.16	14.33	14.56	14.19	15.06
X13	1.66	1.60	1.90	1.98	1.79
X14	4.84	3.15	4.22	5.03	4.31
X15	0.28	1.26	0.77	0.55	0.72
X16	0.99	0.79	0.67	0.59	0.76
X17	0.39	0.51	0.44	0.57	0.48
X18	2.18	2.47	2.94	3.16	2.69
X19	0.53	1.27	1.12	1.00	0.98

X20	2.91	4.07	2.80	3.24	3.25
X21	0.30	0.62	0.83	0.60	0.59
X22	2.94	3.66	4.26	4.06	3.73
X23	2.00	0.92	1.16	1.29	1.34
X24	2.36	3.49	2.35	2.12	2.58
X25	0.15	0.81	0.73	0.44	0.53
X26	0.18	1.40	1.45	1.22	1.06
X27	0.49	0.46	0.97	1.14	0.77
X28	0.22	1.08	0.82	0.55	0.67
X29	11.90	9.97	10.86	10.95	10.92
X30	12.80	10.93	9.91	10.97	11.16

4. Conclusions

Based on the above research results and discussions, the following conclusions can be drawn:

(1) From 2005 to 2020, the development level of urban-rural integration has significantly improved. Except for the significant downward trend in the development level of urban-rural economic integration in Jiangsu in 2013, the development level of urban-rural ESE integration in other regions fluctuated and increased.

(2) The overall distribution of the development level of urban-rural integration in the YRD region follows a pattern of "high in the north and low in the south". High level areas are represented by Nanjing and Wuxi in the southern part of Jiangsu and Shanghai, while low level areas are concentrated at the north and south ends of the YRD region.

(3) The top three barrier layers are industrial structure, spatial connection, and environmental treatment, among which the barrier factors of secondary and tertiary industry employment, land urbanization rate, comprehensive utilization rate of livestock and poultry manure, and ratio of villages handling domestic waste occupied the dominant position.

Therefore, these recommendations are given in regard to the results:

(1) Promote the construction of regional coordinated urban-rural governance mechanisms. There is an imbalance in the development of urban-rural integration within the YRD region, and it is necessary to break through the geographical scope to build an integrated urban-rural mechanism. Firstly, it is necessary to clarify the rights and responsibilities of governments at all levels and relevant departments in promoting urban-rural integration. On the basis of coordinating the interests of all parties, fragmented urban-rural development goals should be integrated. The quality evaluation standards should be formulated based on local conditions and included in the performance evaluation system, ensuring effective supervision by higher-level governments. Secondly, the advantages and demand biases of urban-rural development in different regions need to be fully explored, and the regional development focus of urban-rural integration needs to be adjusted in a timely manner, seeking intergovernmental cooperation between different regions that align with the goals, reducing disorderly competition. At the same time, it is important to strengthen the radiation and spillover effects of the central cities of the metropolitan area, such as Shanghai and Nanjing, on the peripheral cities of northern Jiangsu and southern Zhejiang, so as to alleviate the shackles of the low-level areas arising from factors such as geographic location and resource endowment. Finally, digital technology should be used to empower urban-rural integration, broaden the participation channels of enterprises, the public and other subjects, build a pluralistic discourse system with a digital government platform, collect information and integrate interests, such as the construction of the YRD Urban-Rural Integration Sharing Think Tank, which will regularly update the relevant successful experiences and convene experts to analyze them, help backward regions to carry out practical rehearsals, and provide intellectual support for the advancement of urban-rural integration (Chen, & Zhu, 2023).

(2) Promote high-quality development of rural industries. The YRD region should vigorously promote the process of agricultural modernization, cultivate new types of rural business entities and production organizations, pay

attention to the investment and application of modern factors such as technology, talent, and information in agricultural production, and enhance the technological content and derivative value of various links in agricultural production, such as building "smart" high standard farmland, introducing CNC machinery precision operation, and digital home farms, in order to improve agricultural production efficiency and economic benefits. In addition, relying on the developed e-commerce system and vast consumer market, we will develop agricultural product e-commerce and new online marketing formats to extend the agricultural industry chain, value chain, and market chain, stimulate the growth of new rural industry formats, and continuously expand the income increasing channels and income levels of agricultural operators. At the same time, establish a smooth urban-rural agricultural market network, e-commerce platforms, and cold chain logistics market infrastructure to promote two-way interaction between agricultural products entering the city and industrial products going to the countryside, continue to narrow the urban-rural economic gap, and provide endogenous impetus for urban-rural integration development.

(3) Pay attention to ecological environment protection and attach importance to rural pollution treatment. The ecological environment not only directly affects the quality of resident life, but also is the key to achieving long-term and sustainable urban-rural development. At present, the YRD region has achieved certain results in the control of industrial pollution, while ecological maintenance in rural areas is often overlooked. Measures should be taken to enhance the ecological awareness of rural residents, update their pollution treatment technologies, and form standardized management of the rural ecological environment. At the same time, we need to pay special attention to the environmental issues caused by its coal consumption and industrial production, leverage its technological advantages, and choose clean or renewable energy to promote green production.

5. Declaration about funding and conflict of interest

This study was supported by funding from the "Jiangsu University's 22nd Batch of Student Research Project Support Project (22C229)".

The authors are sincerely grateful to the experts, scholars and editors for their guidance, and declare no potential conflicts of interest.

Reference

1. Al-Mulali,U. & Ozturk, I. (2015). The effect of energy consumption, urbanization, trade openness, industrial output, and the political stability on the environmental degradation in the MENA (Middle East and North African) region. Energy, 84, 382-389.https://doi.org/10.1016/j.energy.2015.03.004.
2. Chen, D.L. (2020). Research on the Evaluation of the Coordination Degree of the Energy-Environment-Economy System in the Yangtze River Delta under the Open Economic Environment. Modern Economic Research, 468(12), 74-79, https://doi.org/10.13891/j.cnki.mer.2020.12.011
3. Chen, H., Zhu, X.Y. (2023). The impact of "weak-weak" intergovernmental structural factors on cross regional public service collaboration policies under regional integration: A case study based on adjacent public transportation in Y city of the Yangtze River Delta. Public Management and Policy Review, 12 (02), 24-42.
4. Dong, H.Z. & Han R.G. (2021). Spatiotemporal evolution and driving factors of urban quality development in a complex ecosystem: taking the seven major urban agglomerations along the yellow river basin as examples. Human Geography, 36(06), 96-107.https://doi.org/10.13959/j.issn.1003-2398.2021.06.011.
5. Fan, J., Zhao, H. & Guo R. (2022). The New Trend and Coping Strategies of Regional Development Gap in China. Economic Geography, 42(01), 1-11. https://doi.org/10.15957/j.cnki.jjdl.2022.01.001.
6. Guan, S. (2022). Temporal Changes and Spatial Divergence in the Level of Urban-Rural Integration in the Yangtze River Delta Region. Modern Economic Research, 489(09), 124-132. https://doi.org/10.13891/j.cnki.mer.2022.09.007.
7. Han, W.L. & Wu, F.H. (2020). The Theory of Integrated Urban-Rural Development in the New Era and How to Make It Happen. Marxism & Reality, 165(02), 166-173. https://doi.org/10.15894/j.cnki.cn11-3040/a.2020.02.022
8. Hou, S.J. (2021). The Green Dilemma and Path of Urban-Rural Integration Development In The New Era. Journal of Socialist Theory Guide, 01, 91-97.

9. Jin C.W. (2019). The Integration of Urban Rural Development and Theoretical Integration in China: A Critical Reference to Contemporary Development Economics Theory. Economic Research, 54 (08), 183-197.
10. Liao, Z.J., Wang, L. & Yang, W. (2019). Economic Agglomeration and Development of Regional Urban-Rural Integration ——An Empirical Analysis Based on Spatial Econometric Model. Soft Science, 33(08), 54-60+72. https://doi.org/10.13956/j.ss.1001-8409.2019.08.10.
11. Lu, Y.C., Gao, X.H. & Liu, M. (2021). Efficiency Leakage and Time Spatial Differentiation of Coupling and Coordinated System of Urban-Rural Development. Rural Economy, 461(03), 101-109.
12. Shi, C.X., He, X.R., P, K.J. (2023). The spatiotemporal evolution and obstacle factor identification of high-quality development level in the Yangtze River Economic Belt. East China Economic Management, 37 (06): 20-31. https://doi.org/10.19629/j.cnki.34-1014/f.221114002
13. Shi, J.G., Duan, K.F. & Wu, G.D. (2022). The Measurement of the Urban-Rural lntegration Development Level in the Yangtze River Delta Region and the Analysis of Its Spatio-Temporal Characteristics. Journal of Tongji University (Social Science Edition), 33(01), 78-89.
14. Sun, P. & Zeng G. (2013). Construction of the Basic Theoretical System for the Planning of Main Functional Zones in Chinese Metropolis —— Based on composite Ecological systems theory. Research on Development, 164(01), 26-29. https://doi.org/10.13483/j.cnki.kfyj.2013.01.018
15. Wu, X.L., Tan Q.M. (2018). Urban Rural Ecological Integration Development: From "Strategic Governance" to "Rule of Law Governance". Economic System Reform, 5, 67-72
16. Zeng, Z.X., Duan, D.H., Zhang, P. & Wang, X.F. (2008). On the Mechanism of Regional Development Based on Complex System Theory ——— A Case Study of Jing-Jin-Ji Region. Reformation & Strategy, 173(01), 89-91+114. https://doi.org/10.16331/j.cnki.issn1002-736x.2008.01.016
17. Zhang, H.P., He, R.W. & Li, G.Q. (2020). Spatiotemporal Evolution of Coupling Coordination Degree of Urban-Rural, Integration System in Metropolitan Area and Its Influencing Factors: Taking the Capital Region as an Example. Economic Geography, 40(11), 56-67. https://doi.org/10.15957/j.cnki.jjdl.2020.11.007.
18. Zhang, Y.X. & Shao, X.W. (2022). Measurement and Evaluation of Urban-Rural Integration Development Level in Jilin Province and Research on Development Path. Agricultural Economy 2022, 418(02), 96-98.