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Quality Analysis and Regional Differences of the Digital Economy in China's Provinces

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Abstract

This paper employs factor analysis to construct a comprehensive assessment system for the digital economy, providing a thorough evaluation of the digital economy development in China's 30 provinces and cities. The research reveals the regional disparities in China's digital economy development, with the east-ern region leading, the central region in the middle, and the western and north-eastern regions developing relatively slowly. Key factors influencing the level of digital economy development include the level of information technology de-velopment, technological innovation and R&D, application of informatization, and e-commerce development, as well as communication infrastructure and services. Cluster analysis further categorizes the provinces into five groups, of-fering valuable insights for policymakers and businesses. Based on these find-ings, the paper suggests strengthening digital infrastructure construction, pro-moting industrial digital transformation, enhancing digital innovation, and deepening regional cooperation to foster balanced development of China's digital economy.

Keywords

Digital Economy; Factor Analysis; Evaluation Index System; Cluster Analysis

1. Introduction

In today's digital information age, the economic development model centered around digital technology has become a new engine for China's economic growth, prompting a shift from rapid growth to high-quality growth [1]. This transformation signifies that economic growth will rely more on innovation and technological advancements, rather than traditional human and material resources. On the other hand, among the numerous economic activities encompassed by the digital economy, information resources are crucial factors of production. Therefore, effective utilization of information and digital technologies is key to enhancing productivity and optimizing the economic structure [2]. Relevant statistical departments and academia have been exploring and establishing a more scientific and comprehensive evaluation index system for the digital economy. However, the digital economy is a complex and multifaceted concept that cannot be measured by a single factor, and its evaluation requires a comprehensive evaluation method based on multiple indicators. The application of comprehensive index evaluation methods in the field of economic management has matured, including four steps: establishing an index system, processing sample data, determining index weights, and constructing an evaluation method. This approach is widely used in evaluating high-quality development levels [3], measuring common prosperity [4][5], and researching the evaluation and measurement of Chinese-style modernization [6]. Currently, many scholars have also conducted relevant measurement studies on the digital economy. For example, Meng Xianming et al. [7] discussed the measurement methods of digital economy development and analyzed the main factors affecting digital economy development. Wei Manman et al. [8] measured the level of digital economy development in Jiangsu Province and concluded that Jiangsu's digital economy has been rapidly developing in recent years, with certain regional differences. These studies provide research perspectives and theoretical foundations for the construction of the index system in this paper.

The potential marginal contributions of this paper include: Firstly, it constructs an index evaluation system for the digital economy development level from multiple perspectives, which can comprehensively reflect the development status of the digital economy. Secondly, this paper employs factor analysis to measure and evaluate the digital economy development level. Compared with traditional statistical analysis methods, factor analysis can better identify potential factors in the data, improving the accuracy and effectiveness of the evaluation. Lastly, based on its findings, the paper provides policymakers and businesses with valuable information and offers corresponding suggestions.

2. Research Design

2.1. Digital Economy Indicator System

In recent years, research on the measurement of the digital economy development level can be roughly divided into two categories. The first category focuses on the macro evaluation of the overall development level of the digital economy. For example, Xu Xianchun and Zhang Meihui[9] measured the value added of China's digital economy from 2007 to 2017, finding that in 2017, the value added of China's digital economy was 53028.85 billion yuan, approximately 58.12% of the United States during the same period. Cai Yuezhou and Niu Xinxing [10]calculated that the average growth rate of China's digital economy from 1993 to 2020 was 16.3%. However, these studies may not fully consider the differences in the development of the digital economy in different regions of China, lacking specific measurement standards for specific regions and development stages, which may affect the accurate understanding and assessment of inter-regional digital economy development. The second category is to construct a digital economy development index, in which researchers usually select several representative indicators to measure based on the basic conditions of digital economy development, including digital infrastructure, informatization industry, digital users, digital innovation, digital platforms, etc[11][12]. Unlike the first category, which measures the digital economy from a single angle, this paper will conduct a comprehensive measurement of the digital economy. Referring to the practices in existing literature [13][14], a digital economy development level evaluation system covering four dimensions: digital infrastructure, digital industrialization, industrial digitalization, and digital innovation, is constructed. Due to the limitations of data availability, 30 provinces (autonomous regions, municipalities directly under the Central Government, excluding Xinjiang, Hong Kong, Macau, and Taiwan) in China in 2022 are selected as research samples. The data are mainly sourced from the "China Statistical Yearbook" published by the National Bureau of Statistics and the Digital Inclusive Finance Index released by Peking University.

2.2. Factor Analysis System

Taking the 30 provinces across the country as research subjects, each subject has 19 evaluation indicators, represented by $X_i(i=1,2,\cdots,19)$ .Firstly, the data corresponding to each evaluation indicator are standardized to eliminate discrepancies caused by different units, thereby ensuring data consistency and comparability.

$$Z_i=\frac{X_i-X_{\min}}{X_{\max}-X_{\min}}=\frac{X_i-Mean}{Sd} \tag{1}$$

Where X_i is the original data, Z_i is the standardized data, $F_1,F_2,\cdots,F_m$ represents the common factors with m eigenvalues greater than 1, $\varepsilon_1,\varepsilon_2,\cdots,\varepsilon_m$ represents the error vector.Then,the factor analysis model can be expressed as:

$$\begin{cases} X_1=a_{11}F_1+a_{12}F_2+\cdots+a_{1m}F_m+\varepsilon_1 \\ X_2=a_{21}F_1+a_{22}F_2+\cdots+a_{2m}F_m+\varepsilon_2 \\ \quad\vdots \\ X_{19}=a_{191}F_1+a_{192}F_2+\cdots+a_{193}F_m+\varepsilon_{18} \end{cases} \tag{2}$$

$a_{ij}(i=1,2,\cdots,19;\ j=1,2,\cdots,m)$ represents the factor loading of the th variable on the th common factor,Where $\left|a_{ij}\right|$ is larger ($\left|a_{ij}\right|\le 1$), indicating that the th common factor has a more significant effect on the th variable, Equation(2) can also be expressed in matrix form: $X=AF+\varepsilon$, Here, A is a factor loading matrix consisting of factor loadings.

Factor analysis consists of five main steps: First, to test the suitability of factor analysis for the data. This paper uses two key methods, KMO test and Bartlett test; Second, in the process of constructing factors, it is necessary to calculate the factor loading matrix A based on the determined sample data and determine the number of common factors to be extracted. This paper uses the principal component method in factor analysis to identify and extract key common factors, solving the correlation matrix of evaluation indicators, and calculating its characteristic roots and variance contribution rates. Since this paper selects 19 indicators, it can identify 19 principal components($Y_1, Y_2, \cdots, Y_{19}$),The 19 principal components are arranged according to the size of their characteristic roots. The obtained principal components $Y_1, Y_2, \cdots, Y_{19}$ can be expressed by the original variable.

$$\begin{cases} Y_1 = b_{11}X_1 + b_{12}X_2 + \cdots + b_{119}X_{19} \\ Y_2 = b_{21}X_1 + b_{22}X_2 + \cdots + b_{219}X_{19} \\ \vdots \\ Y_{19} = b_{191}X_1 + b_{192}X_2 + \cdots + b_{1919}X_{19} \end{cases} \tag{3}$$

Where $b_{ij} (i = 1, 2, \cdots, 19; j = 1, 2, \cdots, 19)$ represents the component of the characteristic vector corresponding to the correlation matrix R composed of the original variables. Third, enhancing the explanatory power of factor variables. Although the common factors with high loadings are extracted through the principal component method, these common factors may not be significant enough to directly explain their specific practical significance. Therefore, this paper uses the varimax rotation method to rotate the variables and obtain new common factors, making the new common factors more explanatory. Fourth, it is necessary to understand that the absolute value of the factor loadings actually reveals the degree of correlation between the original variable and the common factor . The closer this value is to 1, the more the common factor can explain the variation of the corresponding variable . Therefore, after factor rotation, we aim to obtain factor loading coefficients that are as close as possible to the extreme values of 0 and 1, which allows for a clearer explanation of the relationship between the variables and the common factors.

Fifth, calculating factor scores. After establishing the factor analysis model for the digital economy development evaluation indicator system of the 30 provinces across the country, we calculate the scores of the common factors on each sample. This is done by expressing the common factors as linear combinations of the relevant variables, as shown in Equation(4):

$$F_j = \beta_{j1}X_1 + \beta_{j2}X_2 + \cdots + \beta_{j19}X_{19} \tag{4}$$

3. Empirical Analysis

3.1. KMO and Bartlett's Test of Sphericity

As shown in Table 1, the KMO value is 0.623, which is higher than the critical value of 0.6; the results of Bartlett's test of sphericity indicate that the P-value is 0.000, which is less than 0.05. Therefore, it can be concluded that the data is suitable for factor analysis

Table 1. KMO Test and Bartlett's Test of Sphericity

Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO Value)		0.623
Bartlett's Test of Sphericity	Approximate Chi-Square	928.949

	Degrees of Freedom	171
	Significance	0.000

The characteristic values and variance contribution rates of the original variable correlation matrix are calculated, and 4 common factors with characteristic values greater than 1 are screened out from the 19 variables, and the characteristic values and variance contribution rates of each factor are calculated. As shown in Table 3, the first four common factors with eigenvalues greater than 1 are 7.551, 4.071, 3.350, and 1.3236, respectively, and their cumulative variance contribution rate is as high as 85.64%, indicating that factor analysis can summarize most of the information in the original 19 indicators. It is sufficient to explain the level of digital economy development, and it also means that it is effective to use factor analysis method to evaluate the digital economy development ability of 30 provinces in China.

Table 2. Eigenvalues and Variance Contribution Rates

Factor	Eigenvalue	Difference	Proportion	Cumulative（%）
Factor 1	7.551	3.534	0.397	39.74%
Factor 2	4.017	0.667	0.211	60.88%
Factor 3	3.350	1.997	0.176	78.52%
Factor 4	1.354	0.476	0.071	85.64%

3.2. Factor Rotation

Factor rotation is performed to find variables with a factor loading coefficient absolute value close to 1 under each common factor. By renaming the four common factors mentioned above, effective analysis of practical problems can be carried out.

Table 3. Rotated Factor Loadings Matrix

Standardized Indicators	Factor 1	Factor 2	Factor 3	Factor 4
Z1	0.754	0.472	-0.072	-0.167
Z2	0.911	0.281	-0.040	-0.096
Z3	0.371	0.1920	0.760	0.426
Z4	-0.031	0.172	-0.064	0.804
Z5	0.181	0.088	0.938	0.189
Z6	0.804	0.001	0.476	0.076
Z7	0.960	-0.029	0.196	-0.020
Z8	0.961	0.154	0.089	0.085
Z9	0.911	0.100	0.054	0.113
Z10	-0.270	-0.375	-0.079	0.437
Z11	0.100	0.910	0.016	-0.052
Z12	0.049	-0.024	0.852	0.381
Z13	0.069	0.192	0.926	-0.043

Z14	0.152	0.969	0.148	0.072
Z15	-0.238	0.231	0.714	-0.336
Z16	0.047	0.970	0.135	0.101
Z17	0.027	0.987	0.061	0.095
Z18	0.199	0.964	0.125	-0.000
Z19	0.734	-0.055	-0.036	0.250

The common factor F_1 has a large factor loading on variables X_2 (number of web pages), X_6 (mobile phone base station density), X_7 (proportion of employees in information transmission, computer services, and software industry), X_8 (proportion of information technology services in GDP), and X_9 (proportion of software business revenue in GDP). These indicators are closely related to the level of information technology development in the region, therefore, the common factor F_1 is named as the "Information Technology Development Level Factor".

Common Factor F_2 has a large load on variables X_{14} (number of computers used per 100 people in enterprises), X_{16} (R&D personnel expenses of industrial enterprises above designated size), X_{17} (full-time equivalent of R&D personnel in industrial enterprises above designated size), X_{18} (turnover of technology market), These indicators reflect the technological innovation and R&D capabilities of the region. Therefore, the common factor F_2 is named "Technological Innovation and R&D Capability Factor", which reflects the comprehensive strength of enterprises in terms of technical equipment, R&D investment, researcher allocation, and skills.

Common Factor F_3 has a large factor load on variables X_5 (mobile phone penetration rate), X_{12} (number of websites owned by enterprises), X_{13} (mobile e-commerce transaction volume). These variables reflect the penetration and activity of enterprises in terms of information technology construction and e-commerce applications. Therefore, Common Factor F_3 is named the "Information Technology Application and E-commerce Development Factor".

Common Factor F_4 has a significant factor load on variables X_4 (broadband internet penetration rate), X_{10} (proportion of telecommunications business volume in GDP). his factor can reflect the comprehensive strength of a region in terms of communication network coverage, access capabilities, and service efficiency. Therefore, Common Factor F_4 is named the "Communication Infrastructure and Service Factor".

After naming the above four common factors, it is possible to better explain the development level of the digital economy in various regions of the 30 provinces across the country. Since these four common factors account for 85.64% of the total variance contribution rate, it indicates that under the background of the current rapid development of the national digital economy, the main factors affecting the national digital economy development level are the level of information technology development, technological innovation and R&D, application of information technology in e-commerce development, communication infrastructure and services, etc. In the future, efforts can be made from these perspectives to further improve the construction level of digital infrastructure nationwide, promote the industrial application of digital technology and the digital transformation of traditional industries, encourage innovation, increase investment in technology research and development, improve the digital information environment, and lay a solid foundation for the development of the national digital economy.

3.3. Factor Scores and Comprehensive Evaluation

Table 4. Factor Score Coefficients

Standardized Indicators	Factor 1	Factor 2	Factor 3	Factor 4
Z1	0.147	0.082	-0.081	-0.196
Z2	0.181	0.030	-0.144	-0.144
Z3	0.005	-0.030	0.303	0.303
Z4	-0.063	0.000	0.572	0.572
Z5	-0.021	-0.040	0.156	0.156
Z6	0.136	-0.058	0.020	0.020
Z7	0.188	-0.053	-0.068	-0.068
Z8	0.179	-0.014	-0.005	-0.005
Z9	0.170	-0.024	0.019	0.019
Z10	-0.007	-0.044	-0.282	-0.282
Z11	-0.014	0.193	-0.090	-0.090
Z12	-0.003	-0.026	-0.244	-0.255
Z13	-0.033	-0.001	-0.010	-0.011
Z14	-0.020	0.191	-0.001	-0.001
Z15	-0.068	0.044	-0.212	-0.212
Z16	-0.043	0.195	0.026	0.026
Z17	-0.044	0.203	0.019	0.019
Z18	-0.005	0.193	-0.057	-0.057
Z19	0.136	-0.053	0.134	0.134

Another key purpose of establishing a factor analysis model is to assess the importance of each sample in the overall model. Based on the factor score coefficients in Table 5, we construct the following factor score model:

$$\begin{cases} F_1 = 0.147X_1 + 0.181X_2 + \cdots + 0.136X_{19} \\ F_2 = 0.082X_1 + 0.030X_2 + \cdots - 0.053X_{19} \\ F_3 = -0.081X_1 - 0.144X_2 + \cdots + 0.134X_{19} \\ F_4 = -0.196X_1 - 0.144X_2 + \cdots + 0.134X_{19} \end{cases} \tag{5}$$

After conducting correlation analysis on the digital economy development capabilities of various regions in China and calculating the factor scores, we weight the variance contribution rate of each common factor to obtain the comprehensive index score of the digital economy development capabilities of the 30 provinces, namely:

$$S_i = (39.74 \times F_1 + 21.14 \times F_2 + 17.63 \times F_3 + 7.12 \times F_4) \div 85.64 \tag{6}$$

Where S_i represents the comprehensive score of region i ($i = 1, 2, \cdots, 30$).

Table 5. Common Factor Scores and Comprehensive Scores

Region	Factor 1	Factor 2	Factor 3	Factor 4	S	Ranking
Beijing	4.861	-0.480	-0.932	-0.782	1.880	1
Shanghai	0.979	-0.560	4.795	1.130	1.397	2
Guangdong	0.442	3.627	0.518	-2.232	1.021	3
Jiangsu	-0.374	2.204	0.858	1.269	0.653	4
Zhejiang	0.253	1.82	-0.783	1.550	0.535	5
Tianjin	0.977	-0.755	-0.521	2.025	0.328	6
Shandong	-0.056	1.116	-0.481	0.487	0.191	7
Fujian	-0.011	0.440	-0.734	1.392	0.068	8
Hubei	-0.345	0.277	0.026	-0.092	-0.094	9
Sichuan	-0.008	-0.007	-0.509	0.139	-0.099	10
Shananxi	-0.137	-0.359	0.175	0.212	-0.099	11
Chongqing	-0.058	-0.337	-0.483	1.128	-0.116	12
Liaoning	-0.105	-0.340	0.302	-0.586	-0.119	13
Shanxi	0.050	-0.526	-0.336	0.373	-0.145	14
Henan	-0.390	0.300	-0.236	-0.308	-0.181	15
Anhui	-0.434	0.252	-0.522	0.752	-0.184	16
Hunan	-0.472	0.165	0.030	-0.457	-0.210	17
Hebei	-0.270	-0.005	-0.562	-0.044	-0.246	18
Jiangxi	-0.541	-0.115	-0.296	0.594	-0.291	19
Guangxi	-0.451	-0.457	0.361	-0.808	-0.315	20
Guizhou	-0.167	-0.536	-0.074	-1.138	-0.319	21
Jilin	-0.144	-0.623	0.035	-1.34	-0.325	22
Neimenggu	-0.312	-0.559	-0.053	-0.484	-0.334	23
Heilongjiang	-0.319	-0.591	0.287	-1.255	-0.339	24
Ningxia	-0.533	-0.692	0.056	0.107	-0.397	25
Yunnan	-0.377	-0.483	-0.261	-0.951	-0.427	26
Xinjiang	-0.669	-0.596	0.362	-0.537	-0.428	27
Hainan	-0.416	-0.730	-0.742	1.110	-0.433	28
Gansu	-0.510	-0.681	-0.077	-0.689	-0.478	29
Qinghai	-0.464	-0.774	-0.202	-0.566	-0.495	30

Table 5 shows the scores of each common factor and the comprehensive factor, but the latter can only be used for horizontal comparison between the 30 provinces in

China and does not represent the actual level of digital economy development in a particular province. According to the positive or negative comprehensive factor scores of different regions, we can evaluate whether these regions are better or worse than the national average in terms of digital economy development. If S is greater than 0, it indicates that its digital economy development level has exceeded the national average; conversely, if S is less than or equal to 0, it indicates that the region's digital economy development level has not reached the national average, and the larger the value of S, the higher the region's digital economy development capability. From Table 6, we can see the specific position of each province's digital economy development capability in the country and at the same time know that there are significant differences in the level of digital economy development across the country.

On the one hand, judging from the positive or negative values and magnitude of the comprehensive factor scores: First, in the western and northeastern parts of China, the digital economy development level is generally low. This phenomenon may stem from insufficient infrastructure construction in these regions, such as network infrastructure, data center layout, and cloud computing platform development, which are the foundations of the digital economy. Although the northeastern region has a strong industrial base, it is somewhat inadequate in digital upgrading and infrastructure transformation, and there is still a certain gap compared to the eastern and central regions. In addition, there are relatively few universities and research institutions in the western and northeastern regions, lacking the high-skilled talents and innovative research and development capabilities needed by the digital economy. Second, the digital economy development capability of the central region is also lower than the national average. Possible reasons include: Although the central region occupies a crucial pillar position in the country's high-quality development process, the urbanization rate of the central region is lower than the national average, indirectly affecting the development of the digital economy, and the digital economy development is also uneven among different cities and regions, with some developed cities leading and some small and medium-sized cities developing more slowly. Third, the digital economy development level of the eastern region of our country is obviously leading. This indicates that in the process of developing the digital economy, the eastern region has certain first-mover advantages, and at the same time, it has extensive digital infrastructure, rich talent reserves, and strong capital agglomeration capabilities, providing human capital and financial support for the development of the digital economy. In addition, the eastern region is very rich in innovative resources, and in the future, the eastern region will continue to leverage its advantages to promote the digital economy to progress towards better quality, higher efficiency, greater equity, and more sustainability.

3.4. Cluster Analysis

This paper uses the Ward clustering method in system clustering to cluster the digital economy development of 30 provinces in China, and the specific results are shown in Table 6.

Table 6. Clustering Results of Digital Economy Development Levels in 30 Provinces

Classification	Province
1	Beijing
2	Shanghai
3	Jiangsu、Zhejiang、Guangdong
4	Tianjin、Hebei、Sichuan、Anhui、Jiangxi、Chongqing、Shanxi、Shananxi、Hainan、Fujian、Shandong、Henan、Hubei、Hunan
5	Neimenggu、Liaoning、Jilin、Heilongjiang、Guizhou、Yunnan、Guangxi、Xinjiang、Ningxia、Gansu、Qinghai

Based on the clustering dendrogram and the results of the cluster analysis in Table 6, the digital economy development levels of China's 30 provinces can be objectively divided into five categories. Among them, Beijing constitutes the first category on its own, which may be due to its leading position in policy support, resource aggregation, technological innovation, and the development of high-end industries in the field of the digital economy. Shanghai constitutes the second category on its own, which may be due to its status as a financial center, the degree of opening up to the outside world, and the development of high-end service industries related to the digital economy. Guangdong, Jiangsu, and Zhejiang constitute the third category, which may be due to their good performance in terms of total economic volume, industrial structure upgrading, e-commerce, and the digitalization of manufacturing. Tianjin, Shandong, Fujian, Hubei, Hunan, Henan, Sichuan, Hebei, Chongqing, Anhui, Jiangxi, Shaanxi, Shanxi, and Hainan constitute the fourth category. The provinces in this category may be relatively backward in the development of the digital economy, but they also have their own advantageous characteristics, such as Sichuan's electronic information industry and Shandong's manufacturing industry. Inner Mongolia, Liaoning, Jilin, Heilongjiang, Guizhou, Yunnan, Guangxi, Xinjiang, Ningxia, Gansu, and Qinghai are classified into the fifth category. The provinces in this category have a large gap with the first four categories in terms of digital economy infrastructure construction, economic foundation, resource endowment, and policy support, so they are relatively lagging in the development of the digital economy. The results of the cluster analysis are basically consistent with the results obtained from the above factor analysis. The provinces in the first three categories are all provinces in the eastern region with developed digital economy levels. The provinces in the fourth category basically belong to the central region, and the provinces in the fifth category basically belong to the western and northeastern regions, with relatively backward digital economy development capabilities.

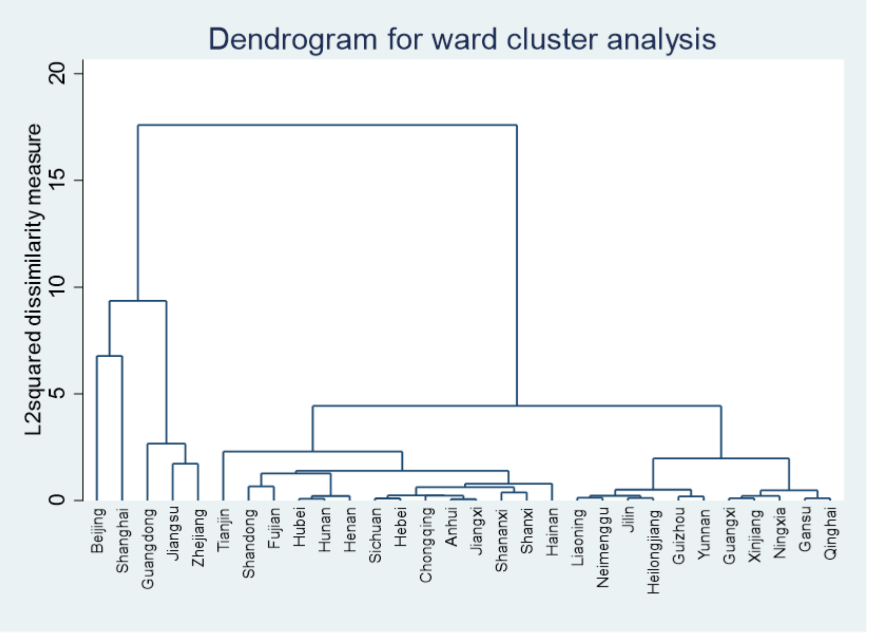

Figure 1. Clustering Dendrogram

4. Research Conclusions and Recommendations

4.1. Research Conclusions

This paper constructs a comprehensive evaluation index system for the digital economy and uses factor analysis and clustering methods to evaluate the digital economy development status of China's 30 provinces. The following conclusions are drawn: Firstly, China's digital economy has achieved rapid development, especially in some eastern provinces such as Beijing, Shanghai, Jiangsu, Zhejiang, and Guangdong, where the level of digital economy development is significantly better than that of other provinces, forming a cluster of digital economy centers characterized by "high level, emphasis on innovation, and strong scale." The central region is at an intermediate level, forming a new competitive landscape of "pursuing innovation and focusing on characteristics." The digital economy development in the western and northeastern regions is relatively lagging, forming a new development trend of "seeking breakthroughs and accelerating growth." There are significant differences in the level of digital economy development among different regions. Therefore, while accelerating the development of the real economy, each province must pay more attention to the development of the digital economy. Secondly, factor analysis reveals that the main factors affecting the digital economy development level of all regions in China include the level of information technology development, technological innovation and R&D, informatization application and e-commerce development, communication infrastructure and services, etc. This also provides directions and focus for the future development of the digital economy in various regions. The imperfect and unbalanced development of the digital economy's basic industries and infrastructure within regions leads to significant differences in the digital economy development capabilities among regions. Therefore, to achieve high-quality sustainable economic development, it is imperative to develop the digital economy industry, improve infrastructure construction, and promote digital innovation.

4.2. Research Recommendations

Firstly, improve digital infrastructure. Local governments should continue to increase investment in broadband network construction, aiming to enhance network speed and coverage. Especially in rural and remote areas where network coverage is still insufficient, more investment and effort are needed to ensure that these regions can also enjoy the convenience and opportunities brought by the development of the digital economy. Additionally, data centers are important foundational supports for the digital economy, and the government should encourage enterprises to invest in the construction of high-performance data centers that provide efficient data storage and processing capabilities.

Secondly, promote the digital transformation of industries. As the core of the digital economy, the government should drive traditional industries to upgrade and improve through the adoption of digital technologies. By applying digital technologies, production efficiency can be increased, costs can be reduced, and the quality of products and services can be enhanced. At the same time, corresponding policies should be introduced to support corporate digital transformation, such as tax incentives and financial support, to reduce operational costs and increase the enthusiasm of enterprises for transformation.

Thirdly, strengthen the role of digital innovation. Digital innovation, as a key driver of the digital economy, has a profound impact on enhancing national competitiveness, promoting economic growth, and improving people's lives. The government should encourage the widespread application of digital technologies, promote the deep integration of digital technologies with various industries, and actively advocate for international cooperation in the digital economy, introducing advanced technologies and management concepts from abroad. By strengthening international exchanges and cooperation, China's international competitiveness in digital innovation can be further enhanced, promoting high-quality development of the digital economy.

Fourthly, deepen regional cooperation. The digital economy development levels vary significantly among different regions in China. To prevent the further widening of the digital divide, regions need to strengthen exchanges and cooperation with each other, promote resource sharing, optimize resource allocation, and achieve mutual benefit and win-win outcomes. Strengthening cooperation on digital infrastructure construction between regions will provide support for regional cooperation. At the same time, each region needs to continue innovating, exploring reform and innovation paths in the digital economy era, and promoting the coordinated development of the digital industry across regions.

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