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Abstract: In the critical period of China's economic transformation, the new generation of information technology plays an important role, and the key to the development of the new generation of information technology industry lies in innovation. This paper takes 31 Chinese provinces and cities as the research objects, and based on the data related to the innovation capability of the new generation of information technology industry from 2010 to 2019. Firstly this paper analyzes the spatial and temporal evolution of the innovation capability of the new generation of information technology industry in 31 Chinese provinces and cities using the entropy method. Secondly, principal component regression analysis is applied to analyze the main influencing factors of the innovation capability of the new generation of information technology industry and its degree of influence. Then it was concluded that the innovation capability of China's new generation of information technology industry showed an overall upward trend, but the growth rate slowed down in 2018; there were obvious differences between the innovation capability of coastal regions and inland regions, and the regional development was unbalanced; the factors that had a greater impact on the innovation capability were focused on the capital investment in innovation (41.839%) and talent investment (26.975%). Finally, it proposes to strengthen the core technology research and development to accelerate the development of independent innovation, and improve the industrial development environment.

Keywords: New generation of information technology industry, Innovation ability, Entropy method, Principal component regression analysis.

1. Introduction

According to the Statistical Bulletin of the Software and Information Technology Service Industry in 2020 published by the Ministry of Industry and Information Technology of the People's Republic of China, the number of enterprises in this industry in China exceeded 40,000 in 2020, generating cumulative revenue of more than 816.16 billion yuan, an increase of 13.3% year-on-year, and the increase in the digital economy in a broad sense reached 36.2% of GDP. In a period of deep transformation of China's economy, China's digital economy is showing a trend of rapid growth through the continuous promotion of the digital revolution [1]. Especially under the impact of the new crown pneumonia epidemic, it still maintains a good momentum of development and has become the new engine of China's economic development [2]. The key to achieving the goal of accelerating the construction of the digital economy and strengthening the new engine of economic development is to strengthen the research on key core technologies [3]. As an important part of the key core technology, the new generation of information technology industry plays a pivotal role in gathering technological innovation resources, optimizing industrial structure, and improving the overall innovation capability and economic strength of the country. The Fifth Plenary Session of the 19th CPC Central Committee adopted the Proposal of the CPC Central Committee on Formulating the 14th Five-Year Plan for National Economic and Social Development and the 2035 Visionary Goals (hereinafter referred to as the Plan), in which it is clearly stated that: accelerating the realization of the promotion and application of key technologies, while emphasizing the need to accelerate key core technology innovation [4], the role of innovation for key core technologies is evident. Although China's new generation of information technology industry is growing steadily, there are still many unknowns and challenges in the ever-changing competition of information industry. To realize the development of the new generation of information technology industry into the main driving force of economic development mode transformation and industrial structure optimization, the key to change this situation lies in innovation.

2. Literature Review

As the application area of the new generation of information technology industry becomes more and more extensive and influential, scholars also pay more attention to the new generation of information technology industry. In terms of research objects, Yongping Fu et al. (2016) used data of listed companies in strategic emerging industries to conduct innovation capability research [5]; Wewei Dong et al. (2018) took China's key autonomous demonstration zones as an example to analyze the innovation capability of strategic emerging the new industries in autonomous demonstration zones [6]; Xiaomei Hu et al. (2019) took the Yangtze River Economic Belt as a research object and analyzed the 11 provinces in the Yangtze River Economic Belt's technological innovation capability of strategic emerging industries [7]; Hongqi Wang et al. (2020) used Heilongjiang province as an example to quantitatively analyze the innovation capability of regional strategic emerging industries [8].
In terms of research perspectives, XingCao et al. (2017) studied the technological innovation capability of strategic emerging industries using the pharmaceutical manufacturing industry in Hunan Province as an example [9]; WeizhuZhu et al. (2017) studied the regional innovation of the new generation of information technology industry using data related to the new generation of information technology industry in eight economic zones [10]. YunfeiShao et al. (2019) conducted a study on the innovation capability of strategic emerging industries based on the data of strategic emerging industries in 31 provinces in China [11]; XiangLi et al. (2019) collected data of A-share listed companies in strategic emerging industries in China and analyzed the impact of tax preferential policies on the independent innovation capability of companies in strategic emerging industries [12]; Xing Li et al. (2019) used 2015 data related to strategic emerging industries from four municipalities and 27 provinces in China as a research sample to analyze the differences in ecological innovation capability of strategic emerging industries in China's provinces [13]; Chen Zhang et al. (2021) analyzed the innovation performance of strategic emerging industry companies listed on A-shares in Shanghai and Shenzhen from 2014 to 2017 [14].

In terms of research methods, Jing Mao (2016) used cluster analysis to analyze the independent innovation capability of strategic emerging industries in Sichuan Province [15]; Yanglin Chen et al. (2018) used propensity score matching method (PSM) to study the incentive effect of tax incentives on innovation investment in strategic emerging industries [16]; Junzhou Yan et al. (2019) used BCC model, super efficiency model and regression model to evaluate the supply-side innovation efficiency of China's strategic emerging industries from 2013 to 2015 [17]; Zejiong Zhou et al. (2019) used a dynamic panel econometric model to analyze the internal and external drivers of independent innovation capability of China's strategic emerging industries [18]; Yu Xue et al. (2020) used a grey fuzzy comprehensive evaluation model to evaluate the strategic emerging industries' innovation capability of 30 Chinese provinces [19].

Through the above analysis, it can be seen that: in terms of research objects, the evaluation objects are mainly divided into two categories, one is to evaluate the innovation capability of the new generation of information technology industry (or strategic emerging industries) in China or a certain region, and the other is to analyze the innovation capability by combining enterprise data; in terms of research perspectives, there are mainly two major directions of evaluation perspectives, one is to make a comprehensive evaluation of industrial innovation capability, and the other is to evaluate a certain aspect of innovation capability like industrial regional innovation capability, technological innovation capability or independent innovation capability. In terms of research methods, scholars use cluster analysis method, PSM, DEA model, panel econometric model and gray fuzzy comprehensive evaluation to study the innovation capability. Through the analysis, we found that there are fewer studies on the new generation of information technology, mainly on strategic emerging industries, and the studies on innovation capability of the new generation of information technology focus on a certain dimension of time or space, and even fewer studies on the analysis of its influence factors.

Therefore, this paper collects data related to the new generation of information technology industry in 31 provinces and cities in China from 2010-2019. Firstly, the innovation capability evaluation index system of the new generation of information technology industry is constructed from two dimensions of knowledge output and product output. Secondly, the entropy method was applied to analyze the spatial and temporal evolution pattern of the innovation capability of the new generation of information technology in 31 provinces and cities in China from 2010 to 2019. Then, the principal component regression analysis is applied to categorize the nine indexes into three aspects, namely, capital investment, talent investment and industrial environment, and analyze the influencing factors of the new generation of information technology industry and the degree of influence of each factor. The research on the spatio-temporal evolution of innovation capability of the new generation of information technology industry and the analysis of influencing factors have high practical significance and research value for guiding the government to correctly understand the innovation capability of local the new generation of information technology industry, guiding the government to implement the innovation-driven development strategy, and helping the development of the new generation of information technology.

3. Construction of Innovation Capability and Influence Factors Indexes of the New Generation of Information Technology Industry


The new generation of information technology industry mainly includes the next-generation communication network industry, Internet of Things, tri-network convergence, high-performance integrated circuits, the new flat-panel displays and high-end software industry represented by cloud computing [28]. The innovation capability reflects the industrial efficiency and competitiveness brought by the innovation of the new generation of information technology industry. The innovation of the new generation of information technology industry mainly stays at the stage of theoretical research at the initial stage, and commercialization of theoretical research results is realized at a later stage, while the new generation of information technology as a general-purpose technology not only generates benefits, but also reacts and penetrates the industry and promotes its development [10]. Therefore, the innovation capability of the new generation of information technology industry can be evaluated in three aspects: the knowledge output capability, the product output capability, and the innovation penetration capability. Knowledge output capability reflects the effectiveness of theoretical innovation obtained by the research of the new generation of information technology industry talents, which is the basis for transformation into innovative products, mainly reflected by the number of industrial invention patents/number of industrial patent applications \(A_1\), the number of industrial invention patents/number of R&D personnel \(A_2\), and the number of industrial published scientific and technical papers/number of R&D personnel \(A_3\). Product output capability is the ability to commercialize theoretical innovation research results, reflecting the innovation benefits of the new generation of information technology industry, mainly analyzed from 2
aspects: the number of the new product development projects (A2) and technology market turnover (A5). In addition, the new generation of information technology innovation not only can obtain output, but also will reflect the field, penetrate the industry, enhance the competitiveness of the industry to obtain higher profits, mainly analyzed from 2 aspects: the number of information transmission, computer services and software industry employees per 10,000 people (A6) and the total profit of the industry (A7). The specific indexes are shown in Table 1.

3.2. Selection of Variables Influencing the Innovation Capability of the New Generation of Information Technology Industry

It is clearly stated in the Plan that the overall innovation level of China’s the new generation of information technology industry is not high enough, and the core technology in some fields is restricted by others. During the "14th Five-Year" Plan period, it is necessary to create the environment required for innovation drive, optimize talent, technology and capital, and accelerate the development and growth of a number of the new industries such as the new generation of information technology industry. Specifically analyzed by 2 generations of information technology development, and analyzes the results of the degree of government support, talent investment and industrial environment.

Table 1. Evaluation Indexes System for the Innovation Capability of the New Generation of Information Technology Industry

<table>
<thead>
<tr>
<th>Guideline level</th>
<th>Primary Indexes</th>
<th>Secondary Indexes</th>
<th>Weighting</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge Output Capability</td>
<td>number of industrial invention patents/number of industrial patent applications (A1)</td>
<td>0.1735</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>number of industrial invention patents/number of R&amp;D personnel (A2)</td>
<td>0.2409</td>
<td>pieces/person</td>
<td></td>
</tr>
<tr>
<td></td>
<td>number of industrial published scientific and technical papers/number of R&amp;D personnel (A3)</td>
<td>0.0410</td>
<td>articles/person</td>
<td></td>
</tr>
<tr>
<td>Product Output</td>
<td>number of the new product development projects (A4)</td>
<td>0.1677</td>
<td>item</td>
<td></td>
</tr>
<tr>
<td></td>
<td>technology market turnover (A5)</td>
<td>0.1169</td>
<td>billion yuan</td>
<td></td>
</tr>
<tr>
<td>Innovation Penetration Capability</td>
<td>number of information transmission, computer services and software industry employees per 10,000 people (A6)</td>
<td>0.1068</td>
<td>million</td>
<td></td>
</tr>
<tr>
<td></td>
<td>total profit of the industry (A7)</td>
<td>0.1532</td>
<td>billion yuan</td>
<td></td>
</tr>
</tbody>
</table>

4. Measure of Innovation Capability and Influencing Factors of the New Generation of Information Technology Industry

4.1. Entropy Method

In order to avoid the influence of subjective factors on index weights and ensure the scientific and effective weighting of indexes, this paper uses the information entropy of each index to determine its weight. For a certain index, the lower the value of its information entropy means the higher the degree of variation of the corresponding index, the more information the index contains, the greater the importance of the index. Then the entropy method is used to derive the comprehensive score of innovation capability of the new generation of information technology industry for each sample. The specific steps for calculating the weights and comprehensive scores using the entropy method are as follows.

Firstly, the percentage of the jth index of the ith sample in the total sample is calculated using the formula (1).
Secondly, using the formula (2) to analyze the index entropy value $h_j$ for the $j$th term.

$$h_j = \frac{1}{\ln(n)} \sum_{i=1}^{m} b(i,j) \cdot \ln(b(i,j)) (i = 1,2,3 \ldots m)$$ (2)

Then the weights $w_i$ of each index are calculated using the formula (3).

$$w_j = \frac{1-h_j}{\sum_{j=1}^{n}(1-h_j)} (j = 1,2,3 \ldots n)$$ (3)

Finally, the final comprehensive score value $Z$ for each sample was calculated using the formula (4).

$$Z = \sum_{j=1}^{n} w_j \cdot s(i,j) (i = 1,2,3 \ldots m; j = 1,2,3 \ldots n)$$ (4)

### 4.2. Principal Component Regression Analysis

In the case of more explanatory variables, the regression equation is prone to the problems of multicollinearity and failure to test the significance levels of multiple indexes, which cannot accurately reflect the influence of each index on the innovation capability of the new generation of information technology industry. In order to avoid the above situation, this paper reduces the dimensionality of the above indexes based on the principal component analysis to obtain the corresponding principal component factors, and then uses the ordinary least squares (OLS) method to obtain the regression equation (6) based on the relationship between the $k$ principal components.

$$\hat{y} = \hat{b}_1 x_1 + \hat{b}_2 x_2 + \hat{b}_3 x_3 + \ldots + \hat{b}_k x_k$$ (7)

### 5. Empirical Analysis of Innovation Capability and Influencing Factors of the new Generation of Information Technology Industry

#### 5.1. Data Sources and Processing

In 2010, the State Council issued the Decision of the State Council on Accelerating the Cultivation and Development of Strategic Emerging Industries, which clearly proposed to accelerate the development of strategic emerging industries and elevated them to a national strategic level [35]. As one of the seven key strategic emerging industries for development in China, the impact of the new generation of information technology industry cannot be ignored. Since the concept of the new generation of information technology was formally defined in 2010 and there is no special index for statistics, while the new generation of information technology is an important part of high technology. Therefore, in this paper, the data statistics are specified between 2010 and 2019, and some index data are replaced by the data related to high-tech industry instead of the index data of the new generation of information technology industry. The data on R&D institutions, the number of enterprises and industrial development are extracted from the 2011-2020 China High-Tech Industry Statistical Yearbook and the China Information Industry Yearbook, and the population, land area and finance are obtained from the 2011-2020 China Statistical Yearbook, in which some indexes are obtained by processing the original data. The number of enterprises in 2017, the number of high-tech enterprises with R&D activities, the number of information transmission, computer services and software industry employees per 10,000 people, profits and investment amounts in 2018 and 2019 are missing, and this paper uses the proximal point linear trend estimation method to fill in the missing values.

Based on the innovation capability index system of the new generation of information technology industry, relevant data were found and calculated to obtain data related to the evaluation of innovation capability of the new generation of information technology industry in each province and city from 2010 to 2019. Since there are different data orders of magnitude and units among the indexes, the calculation of the comprehensive score of innovation capability cannot be carried out directly. Therefore, this paper performs dimensionless processing of the data. Because the selected indexes are all benefit-type indexes, that is, for a certain index, the larger the value of the index represents the better the benefit of this index, so this paper uses the formula (8) to dimensionlessly process the data of the indexes related to the new generation of information technology industry, so as to obtain standardized data.

$$s(i,j) = \frac{s(i,j) - m(s(i,j))}{M(s(i,j)) - m(s(i,j))}$$ (8)

where, $s(i,j)$ represents the data corresponding to the jth index of the ith sample region, $M(S(i,j))$ represents the maximum value of the data corresponding to the jth index,
and \( m(S(i, j)) \) represents the minimum value of the data corresponding to the jth index.

5.2. Spatial and Temporal Evolution of Innovation Capability of the new Generation of Information Technology Industry

The weights of the indexes of the innovation capability of the new generation of information technology industry in 31 provinces and cities from 2010 to 2019 were calculated using the entropy method, and the specific data are shown in Table 1. The top three indexes in terms of weight are number of industrial invention patents/number of R&D personnel (0.2409), number of industrial invention patents/number of industrial patent applications (0.1735), and number of the new product development projects (0.1677). The indexes with the top three weights focus on the knowledge output capability, indicating that the knowledge output capability has a greater influence on the development of innovation capability of the new generation of information technology industry, and the influence of industrial invention patents is particularly obvious. The greater weight of the number of the newly developed projects reflects that the innovation capability of the new generation of information technology industry is more related to the product output capability.

According to the Regional Planning Method proposed during the 11th Five-Year Plan, 31 provinces and cities in China were divided into eight economic zones based on spatial, economic and natural resource factors [27], and the classification results are shown in Table 3.

<table>
<thead>
<tr>
<th>Table 3. Chinese 31 Provinces and Cities Classification Table</th>
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<tbody>
<tr>
<td>Region</td>
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<tr>
<td>Northeast Region</td>
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<tr>
<td>Northern Coastal Region</td>
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<tr>
<td>Eastern Coastal Region</td>
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<tr>
<td>Southern Coastal Region</td>
</tr>
<tr>
<td>Middle Yellow River Region</td>
</tr>
<tr>
<td>Middle Yangtze River Region</td>
</tr>
<tr>
<td>Great Southwest Region</td>
</tr>
<tr>
<td>Great Northwest Region</td>
</tr>
</tbody>
</table>

Then, according to the classification results of 31 provinces and cities and the comprehensive score data of innovation capability of the new generation of information technology industry from 2010 to 2019, the trend figure of comprehensive score of the new generation of information technology industry in eight economic zones from 2010 to 2019 was drawn, as shown in Figure 1.

It can be seen through Figure 1 that the comprehensive score of the innovation capability of the new generation of information technology industry in the eight economic zones developed well from 2010 to 2019, with an overall upward trend, but the growth rate decreased in 75% of the regions in 2018-2019. Specifically: the Southern Coastal Region, although comprehensive score of the innovation capability of the new generation of information technology industry decreased by 0.0032 in 2010-2011 but the overall development momentum is great. The comprehensive score of the innovation capability of the new generation of information technology industry continued to rise from 0.1350 in 2011 to 0.3120 in 2019, with an average annual increase of about 10.1%. The comprehensive score of the innovation capability of the new generation of information technology industry in the eastern region increased from 0.1299 in 2010 to 0.2457 in 2019, with an average annual growth rate of about 7.4%, and the comprehensive score of innovation nearly doubled. The comprehensive score of the innovation...
second category is the Northern Coastal Region with the first category is the southern and Eastern Coastal Region. The eight economic zones are divided into three categories, the Northeast Region > Great Northwest Region > Great Southwest Region > Middle Yellow River Region. The new generation of information technology industry in the Southern Coastal Region > Eastern Coastal Region > Northern Coastal Region > Western Coastal Region has developed steadily over recent years.

### Table 4. Comprehensive Score and Ranking of Innovation Capability of The New Generation of Information Technology Industry in 31 Provinces and Cities in 2010-2019

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>Beijing</td>
<td>0.05</td>
<td>0.07</td>
<td>0.10</td>
<td>0.12</td>
<td>0.14</td>
<td>0.16</td>
<td>0.18</td>
<td>0.20</td>
<td>0.22</td>
<td>0.24</td>
<td>22</td>
</tr>
<tr>
<td>Tianjin</td>
<td>0.16</td>
<td>0.19</td>
<td>0.22</td>
<td>0.24</td>
<td>0.26</td>
<td>0.28</td>
<td>0.30</td>
<td>0.32</td>
<td>0.34</td>
<td>0.36</td>
<td>1</td>
</tr>
<tr>
<td>Shanghai</td>
<td>0.017</td>
<td>0.02</td>
<td>0.028</td>
<td>0.035</td>
<td>0.037</td>
<td>0.039</td>
<td>0.042</td>
<td>0.044</td>
<td>0.046</td>
<td>0.048</td>
<td>10</td>
</tr>
<tr>
<td>Jiangsu</td>
<td>0.035</td>
<td>0.05</td>
<td>0.051</td>
<td>0.054</td>
<td>0.057</td>
<td>0.059</td>
<td>0.062</td>
<td>0.065</td>
<td>0.067</td>
<td>0.069</td>
<td>7</td>
</tr>
<tr>
<td>Zhejiang</td>
<td>0.08</td>
<td>0.09</td>
<td>0.11</td>
<td>0.12</td>
<td>0.13</td>
<td>0.14</td>
<td>0.15</td>
<td>0.16</td>
<td>0.17</td>
<td>0.18</td>
<td>3</td>
</tr>
<tr>
<td>Fujian</td>
<td>0.01</td>
<td>0.02</td>
<td>0.03</td>
<td>0.04</td>
<td>0.05</td>
<td>0.06</td>
<td>0.07</td>
<td>0.08</td>
<td>0.09</td>
<td>0.10</td>
<td>31</td>
</tr>
<tr>
<td>Guangdong</td>
<td>0.319</td>
<td>0.317</td>
<td>0.356</td>
<td>0.397</td>
<td>0.42</td>
<td>0.484</td>
<td>0.55</td>
<td>0.649</td>
<td>0.698</td>
<td>0.747</td>
<td>1</td>
</tr>
<tr>
<td>Guangxi</td>
<td>0.032</td>
<td>0.031</td>
<td>0.031</td>
<td>0.031</td>
<td>0.031</td>
<td>0.031</td>
<td>0.031</td>
<td>0.031</td>
<td>0.031</td>
<td>0.031</td>
<td>1</td>
</tr>
<tr>
<td>Hebei</td>
<td>0.002</td>
<td>0.006</td>
<td>0.008</td>
<td>0.01</td>
<td>0.012</td>
<td>0.014</td>
<td>0.016</td>
<td>0.018</td>
<td>0.02</td>
<td>0.022</td>
<td>20</td>
</tr>
<tr>
<td>Shanxi</td>
<td>0.031</td>
<td>0.031</td>
<td>0.031</td>
<td>0.031</td>
<td>0.031</td>
<td>0.031</td>
<td>0.031</td>
<td>0.031</td>
<td>0.031</td>
<td>0.031</td>
<td>1</td>
</tr>
<tr>
<td>Xinjiang</td>
<td>0.014</td>
<td>0.016</td>
<td>0.019</td>
<td>0.022</td>
<td>0.025</td>
<td>0.028</td>
<td>0.031</td>
<td>0.034</td>
<td>0.037</td>
<td>0.04</td>
<td>24</td>
</tr>
<tr>
<td>Inner Mongolia</td>
<td>0.012</td>
<td>0.012</td>
<td>0.012</td>
<td>0.012</td>
<td>0.012</td>
<td>0.012</td>
<td>0.012</td>
<td>0.012</td>
<td>0.012</td>
<td>0.012</td>
<td>1</td>
</tr>
<tr>
<td>Tibet</td>
<td>0.002</td>
<td>0.002</td>
<td>0.002</td>
<td>0.002</td>
<td>0.002</td>
<td>0.002</td>
<td>0.002</td>
<td>0.002</td>
<td>0.002</td>
<td>0.002</td>
<td>1</td>
</tr>
<tr>
<td>Qinghai</td>
<td>0.002</td>
<td>0.002</td>
<td>0.002</td>
<td>0.002</td>
<td>0.002</td>
<td>0.002</td>
<td>0.002</td>
<td>0.002</td>
<td>0.002</td>
<td>0.002</td>
<td>1</td>
</tr>
</tbody>
</table>

Analyzing the comprehensive score and ranking table of the innovation capability of the new generation of information technology industry in 31 provinces and cities from 2010-2019, it is easy to see that from 2010-2019, the top 10 provinces and cities in terms of innovation capability of the new generation of information technology industry in major years are Guangdong, Jiangsu, Zhejiang, Beijing, Shanghai, Shandong, Tianjin, Fujian, Hubei and Sichuan, concentrated in the coastal region, where all provinces and cities in the Eastern Coastal Region are firmly in the top 5 in terms of innovation capability of the new generation of information technology industry from 2010-2019.

The four provinces of Liaoning, Chongqing, Tibet and Ningxia were among the top 10 in some years, but their comprehensive scores of the new generation of information technology industry fluctuate greatly. Dividing China's 31 provinces and cities into eight economic zones for analysis, it can be obtained that the development level of innovation capability of the new generation of information technology industry in China's eight economic zones is roughly as follows: Southern Coastal Region > Eastern Coastal Region > Northern Coastal Region > Western Coastal Region > Great Southwest Region > Middle Yellow River Region > Northeast Region > Greater Northwest Region, if the eight economic zones are divided into three categories, the first category is the southern and Eastern Coastal Region. The second category is the Northern Coastal Region with the second strongest innovation capability, and the third category is the inland regions with weaker innovation capability, and the innovation capability of each region differs significantly. Both the Eastern Coastal Region and Northern Coastal Region belong to early modernization development areas, which, together with their unique geographical advantages and national policy support, attract more talents and capital investment, thus promoting the development of the new generation of information technology industry in the Eastern Coastal Region and Northern Coastal Region; although the Southern Coastal Region has a late start compared with the Eastern Coastal Region and Northern Coastal Region in the development of the new generation of information technology industry the Southern Coastal Region is rich in overseas social resources, and coupled with its superior geographical location [10], the new generation of information technology industry is developing rapidly; although the inland regions are developing more slowly, the Middle Yangtze River Region have seen a steady growth in the innovation capability of the new generation of information technology industry in recent years.
5.3. Analysis of Factors Influencing the Innovation Capability of the New Generation of Information Technology Industry

In this paper, with a cumulative contribution of variance of 81.028%, the nine indexes selected as explanatory variables were subjected to principal component regression analysis, and firstly, three principal components were extracted from the nine variables as follows.

\[
\begin{align*}
F_1 &= 0.335X_1 + 0.217X_2 + 0.303X_3 + 0.311X_4 - 0.081X_5 - 0.042X_6 + 0.046X_7 - 0.095X_8 - 0.013X_9 \\
F_2 &= 0.015X_1 - 0.064X_2 - 0.009X_3 - 0.034X_4 + 0.394X_5 - 0.305X_6 + 0.350X_7 - 0.156X_8 + 0.075X_9 \\
F_3 &= -0.098X_1 - 0.015X_2 - 0.054X_3 + 0.053X_4 - 0.092X_5 - 0.114X_6 + 0.033X_7 + 0.773X_8 + 0.443X_9
\end{align*}
\]  
(9)

According to the results of the rotated component matrix, the nine explanatory variables are divided into three principal components, and the specific classification is shown in Table 2. The variance contribution rate of the first principal component is 41.839%, the variance contribution rate of the second principal component is 26.975%, and the variance contribution rate of the third principal component is 12.213%, which shows that the first principal component has the greatest influence on the innovation capability of the new generation of information technology industry, and the index variables of the first principal component focus on the capital investment, reflecting that the capital investment has the most significant influence.

The innovation capability of the new generation of information technology industry calculated by entropy method is used as the explanated variable, and the extracted principal component is used as the explanatory variable, and then OLS is used to establish the regression equation, and the following estimation equation is obtained.

\[
Y = 0.081 + 0.087F_1 + 0.026F_2 + 0.018F_3
\]  
(10)

Based on the regression results, it is easy to see that: the estimated equations pass the statistical significance test and the econometric test at the 5% significance level. The principal component equations extracted from the nine explanatory variables are then substituted, and the regression equations of the composite innovation capability scores for the nine index variables are obtained.

\[
\begin{align*}
Y &= 0.081 + 0.001X_1 + 0.028X_2 + 0.002X_3 + 0.004X_4 + 0.009X_5 + 0.017X_6 + 0.0260X_7 + 0.011X_8 + 0.0256X_9 \\
X_1 &= 0.081 + 0.001X_1 + 0.028X_2 + 0.002X_3 + 0.004X_4 + 0.009X_5 + 0.017X_6 + 0.0260X_7 + 0.011X_8 + 0.0256X_9
\end{align*}
\]  
(11)

In the regression equation, the larger the absolute value of the coefficient corresponding to the explanatory variable, the greater the influence of this index on the innovation capability of the new generation of information technology industry; the coefficient of the explanatory variable is greater than 0, which means that the variable has a positive influence on the innovation capability, and the coefficient of the explanatory variable is less than 0, which has a negative influence. Observing the results of the regression equation, the influence of the above nine variables on the innovation capability of the new generation of information technology industry is positive. The most influential factor is industrial investment amount/local fiscal expenditure which belongs to the field of capital investment, and the five factors with the greatest influence are industrial investment amount/local fiscal expenditure (0.028) > R&D funding intensity (0.0260) >

6. Countermeasures to Improve the Innovation Capability of the New Generation of Information Technology Industry

Today, China is in a critical period of economic transformation, and the new generation of information technology plays an important role, while innovation is one of the main driving forces for the development of the new generation of information technology. Facing the problems of innovation capability of the new generation of information technology industry, this paper proposes the following countermeasures.

6.1. Strengthen Core Technology Research and Development to Accelerate the Independent Innovation Development

Analyzing the composite score of the innovation capability of the new generation of information technology industry in each region from 2010-2019, it can be found that in 2018 the growth rate of the innovation capability of the new generation of information technology industry slowed down in 75% of the regions. This may be correlated with these measures: the adoption of an additional 25% tariff on Chinese products, the ban on the sale of integrated circuits, software and other products to ZTE Corporation and the ban on the sale of Huawei cell phones in 2018 in the United States [23] [24]. It also shows that mastering core technologies is the key to truly enhancing the innovation capability of the new generation of information technology industry. The government should implement relevant policies to protect intellectual property rights and create a favorable innovation environment for enterprises. When pursuing technological innovation, enterprises are prone to the problem of considering the increase in the number of products and industries and momentary benefits, while neglecting the research and development of core technologies. Enterprises should have the business concept of technological innovation, actively guide employees to technological innovation, take the initiative to cooperate and exchange with scientific research institutions, and accelerate the productization of knowledge achievements. In the context of big data and cloud computing, China should combine its own advantages to develop a series of "disruptive technologies" to expand the influence of the new generation of information technology industry.

6.2. Strengthen the Coastal Region's Leading Role to Promote Balanced and Coordinated Industrial Development

Analyzing the spatial difference of innovation capability of the new generation of information technology industry from 2010 to 2019, it is not difficult to find that there is an obvious gap between the innovation capability of the new generation
of information technology industry in coastal areas and inland areas, and the regional development is unbalanced. Therefore, the government should enhance the leading role of innovation in coastal areas while ensuring the stable development of the new generation of information technology industry in coastal areas to achieve balanced and coordinated development of the new generation of information technology industry. Coastal regions attract more foreign enterprises and overseas talents with their unique geographical advantages and excellent foundation of the new generation of information technology, so as to further improve their own innovation capability. Inland areas selectively undertake the new generation of information technology industry in coastal areas, while strengthening technical interaction with enterprises and research institutions in coastal areas to learn about the latest technologies and develop the new generation of information technology industry suitable for the local area by combining advantages, so as to narrow the differences between regions [25].

6.3. Increase Financing Channels to Increase Capital Investment

According to the results of principal component regression analysis, it can be seen that: the variance contribution of capital investment to the innovation capability of the new generation of information technology industry reaches 41.839%, and the factor that has the greatest influence on the innovation capability of the new generation of information technology industry - the industrial investment amount/local fiscal expenditure also belongs to the field of capital investment. As the saying goes, "a clever woman cannot cook without rice", without capital support, it is difficult to carry out relevant scientific research activities and the innovation capability cannot be improved [26]. At present, the main capital investment comes from government financial funds, but it is unreasonable to rely solely on government financial support; the government should actively play the role of propaganda and guidance, and carry out financing through multiple channels. Through the promotion of local the new generation of information technology industry, foreign enterprises are attracted to invest. Most of the new generation of information technology products are intangible products, but it contains invention patents, the government should actively guide the financial sector to set up credit projects related to intangible assets, which can not only solve the problem of enterprise capital, but also stimulate enterprises to research and development of the new generation of information technology products.

6.4. Pay Attention to Talent Cultivation and Enhance Market Competitiveness

Through the results of principal component regression analysis, it can be seen that: the variance contribution of talent investment to the innovation capability of the new generation of information technology industry reaches 26.975%. And in the ranking of the degree of influence of 9 factors, 2 of the top 5 factors in the degree of influence - the intensity of R&D funding intensity and the density of higher education institutions, which focus on talent investment, it is easy to see that the influence of talent investment is very important for the innovation capability of the new generation of information technology industry. Students in higher education institutions play an important role as a reserve force for the development of the new generation of information technology industry. The government should increase investment in education to cultivate more high-quality talents to promote better and faster development of the new generation of information technology. At the same time, universities and enterprises should put the cultivation of scientific and technological talents on the first place and set up majors related to the new generation of information technology or carry out technical training related to the new generation of information technology. In addition, they should implement the corresponding incentive mechanism. Localities should also increase investment in critical the new generation of information technology projects and absorb scientific and technological talents from around the world to join them to create scientific and technological innovation teams. By cultivating students’ or staff's capability to apply the new generation of information technology, we will promote the development of the new generation of information technology industry.

6.5. Strengthen Government Guidance and Provide a Better Environment for Industrial Development

According to the results of principal component regression analysis, it can be seen that: although the principal component variance contribution rate of industrial development environment is only 12.213%, among the 5 factors that have the greatest impact on the new generation of information technology, Internet penetration rate and the number of enterprises with R&D activities/total number of enterprises, which means that all indexes of industrial development environment have a greater impact on the innovation capability of the new generation of information technology industry. Therefore, local governments should strengthen the construction and improvement of infrastructure, such as: Internet and other infrastructure, so as to provide an better environment for the development of the new generation of information technology industry and fully support the development of the new generation of information technology industry. At the same time, the government should improve the development system of the new generation of information technology industry based on two levels of industrial intellectual property protection as well as industrial security management to create a good industrial development environment.

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