***Translation***

*The following report, published by a think tank affiliated with China's Nankai University, compares the strength of the AI industry in various Chinese provinces, cities, and urban agglomerations across an elaborately weighted collection of different metrics.*

**Title**
China's New Generation AI Technology Industry Region Competitiveness Evaluation Index
中国新一代人工智能科技产业区域竞争力评价指数（2022）

**Authors**
The Chinese Institute of New Generation Artificial Intelligence Development Strategies (CINGAI; 中国新一代人工智能发展战略研究院). The individual authors are: Professor Gang Liu (Liu Gang; 刘刚), Yifei Li (Li Yifei; 李依菲), Biao Li (Li Biao; 李彪), Fuman Han (Han Fuman; 韩馥蔓), Zhifang Huo (Huo Zhifang; 霍治方), Fengyang Zheng (Zheng Fengyang; 郑凤阳), Haowei Tong (Tong Haowei; 童皓伟), Jie Wang (Wang Jie; 王杰), Shan Yu (Yu Shan; 余山), and Hanwen Liu (Liu Hanwen; 刘汉文).

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# China's New Generation AI Technology Industry Region Competitiveness Evaluation Index (2022)

**Chinese Institute of New Generation Artificial Intelligence Development Strategies**

*Introduction of Lead Writer*

**Professor Gang Liu**

Professor Gang Liu, born in February 1965, chief economist of Chinese Institute of New Generation Artificial Intelligence Development Strategies (CINGAI), director of Nankai Institute of Economics.

**Main Research Fields:** Innovation Economics and Innovation Policy

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**Other Writers**

| | | |
|---|---|---|
| Yifei Li | Zhifang Huo | Jie Wang |
| Biao Li | Fengyang Zheng | Shan Yu |
| Fuman Han | Haowei Tong | Hanwen Liu |

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# 01 Research Design and Methods

## Research Methods

In our research, we view the development of the artificial intelligence (AI) science and technology (S&T) industry as a complex adaptive system. The rise and development of regional AI S&T industries is an emerging phenomenon in the process of the mutual connections and interactions among various innovation entities including enterprises, university and non-university scientific research institutes, investors, connectors (链接者), and governments. The innovation ecosystem formed by the interaction of various innovation entities is the basis for the vitality and competitiveness of regional AI S&T industries. From the perspective of the innovation ecosystem, this report builds an indicator system to evaluate industry foundations and development environments based on six dimensions: enterprise capability, academic ecosystem, capital environment, international openness, linkage capability, and government responsiveness. This allows us to evaluate the regional development potential and competitiveness level of China's new-generation AI S&T industry.

## Sample Database

Based on the perspective of the innovation ecosystem, this report uses the **China Intelligent Economy Sample Database**[1] (中国智能经济样本库), which includes 2,200 AI enterprises, 5,272 investors (investment institutions and non-investment institutions)[2], 303 AI universities and 123 non-university scientific research institutes, 781 industry alliances, 2,162 conferences held in mainland China, 657 relevant policies issued by 31 provinces, municipalities, and autonomous regions, and the planning and construction conditions of 1,823 AI industrial parks.

We collected data through a combination of actual surveys and big data and built a sample database. The data in the sample database includes two categories: attribute data and relationship data. Attribute data refers to information on the establishment

The sample library includes

| | |
|---|---|
| 2200 | AI Enterprises |
| 5272 | Investors |
| 303 | AI Universities |
| 123 | Non-University Scientific Research Institutes |
| 781 | Industry Alliances |
| 2162 | Conferences |
| 657 | Relevant Policies |
| 1823 | AI Industrial Parks |

[1] The end of data collection for the report was December 2021. Here, conferences refer to AI conferences held in China. Policies refer to the plans, implementation opinions, and action plan policy information issued by local governments. Policies are sourced from the official websites of the governments of various provinces, municipalities, autonomous regions, and key cities. Industry alliances include AI-related industry alliance organizations established by the national and local governments, which are mainly selected based on public data on the Internet.

[2] The investor samples are taken from investors who are relationship nodes in the relationship data of the 2,200 enterprises, including investment institutions and non-investment institutions.

time, region, and sales revenue of innovative entities including AI enterprises. Relationship data refers to information about the relationships and rules of interaction between sample enterprises and other nodes.

## Indicator System

The six first-level indicators and 10 second-level indicators in the regional competitiveness evaluation indicator system for the AI S&T industry are: enterprise scale and enterprise innovation capabilities for enterprise capabilities, innovation capabilities of AI universities and non-university scientific research institutes for academic ecosystem, financing and investment for capital environment, core human capital openness and technology openness for international openness, connectors for linkage capabilities, and government response for government response capabilities. Under the second-level indicators, we set up 24 corresponding third-level indicators to measure the two dimensions of quantity and quality.

Table 1. Indicator system to evaluate regional competitiveness of the AI S&T industry and indicator weights

| Level 1 indicator | Weight | Level 2 indicator | Weight | Level 3 indicator | Weight |
|---|---|---|---|---|---|
| Enterprise capabilities | 0.4368 | Enterprise scale | 0.2045 | Number of enterprises | 0.1782 |
| | | | | Average enterprise valuation/market capitalization | 0.0263 |
| | | Enterprise innovation capabilities | 0.2323 | Average number of enterprise patents | 0.1304 |
| | | | | Number of basic and technology level enterprises | 0.0629 |
| | | | | Number of technological empowerment relationships | 0.0390 |
| Academic ecosystem | 0.2127 | AI university innovation capabilities | 0.1084 | Number of AI universities | 0.0607 |
| | | | | Average number of domestic research papers | 0.0040 |
| | | | | Average number of international research papers | 0.0146 |
| | | | | Average number of patents | 0.0291 |
| | | Non-university scientific research institute innovation capabilities | 0.1042 | Number of institutes | 0.0607 |
| | | | | Average number of domestic research papers | 0.0072 |
| | | | | Average number of international research papers | 0.0072 |
| | | | | Average number of patents | 0.0291 |
| Capital environment | 0.1865 | Financing | 0.1383 | Number of financing relationships | 0.0195 |
| | | | | Amount of financing | 0.1188 |
| | | Investment | 0.0482 | Number of investment relationships | 0.0482 |
| International openness | 0.0776 | Core human capital openness | 0.0294 | Previous international study experience | 0.0091 |
| | | | | Previous international work experience | 0.0203 |
| | | Technology openness | 0.0481 | Number of international technology input relationships | 0.0438 |
| | | | | Number of international technological empowerment relationships | 0.0043 |
| Linkage capabilities | 0.0512 | Connectors | 0.0512 | Number of conferences | 0.0085 |
| | | | | Number of industry alliances | 0.0427 |
| Government response capabilities | 0.0352 | Government response | 0.0352 | Number of AI industrial parks | 0.0293 |
| | | | | Number of policies issued | 0.0059 |

## 1. Enterprise Capabilities

In the evaluation of enterprise capabilities, we selected two second-level indicators, enterprise scale and enterprise innovation capabilities, and five third-level indicators. Of these, the enterprise scale indicator consists of two third-level indicators: number of AI enterprises and the average enterprise valuation/market capitalization.

The number of enterprises is measured using the distribution of the 2,200 AI enterprises in each region. The average enterprise valuation/market capitalization indicator is measured using the average valuation/market capitalization of the valid sample enterprises in each region.

The enterprise innovation capabilities indicator includes three third-level indicators: average number of enterprise patents, number of basic and technology level[3] enterprises, and number of technological empowerment relationships.

The average number of enterprise patents is measured using the average number of patents of valid sample enterprises in each region. The enterprise-level indicators are measured using the number of basic and technology layer sample enterprises in each region. The number of enterprise technological empowerment relationships is measured by using the number of technological empowerment relationships in the technological relationships of the sample enterprises in each region.

## 2. Academic Ecosystem

Academic ecosystem includes 2 second-level and 8 third-level indicators. The 2 second-level indicators are AI university innovation capabilities and non-university scientific research institute innovation capabilities.

The AI university innovation capabilities indicator includes four third-level indicators, number of AI universities, average number of domestic research papers, average number of international research papers, and average number of patents. The non-university scientific research institute innovation capabilities indicator includes four third-level indicators: number of institutes, average number of domestic research papers, average number of international research papers, and average number of patents. The relevant indicators are measured using the actual distribution of the 303 AI universities and 123 non-university scientific research institutes selected in this report in each region. The total number of published research papers is measured using the total number of research papers from the valid samples in each region, and

[3] Artificial intelligence basic level and technology level enterprises refer to enterprises that provide basic technologies including big data, cloud computing, edge computing, and smart chips, and enterprises that provide core technologies including core algorithms. Compared with application layer enterprises, basic layer and technology layer enterprises have stronger innovation and influence (辐射) and leading capabilities.

the total number of patents is measured using the total number of patents of the valid samples in each region.

### 3. Capital Environment

Capital environment includes 2 second-level and 3 third-level indicators. The 2 second-level indicators are financing and investment.

The financing indicator includes 2 third-level indicators, number of financing relationships and amount of financing. The investment indicator includes 1 third-level indicator, number of investment relationships. Of these indicators, the numbers of investment and financing relationships are measured using the total number of investment and financing relationships in each region of the 2,200 sample companies, while the enterprise amount of financing indicator is measured by the total financing amount of valid sample companies in each region.

### 4. International Openness

International openness measures the capability to integrate international resources in the development of regional AI S&T industries. Moreover, we established 2 second-level indicators: core human capital openness and technology openness.

Core human capital openness includes 2 third-level indicators: previous international study experience and previous international work experience. Technology openness includes 2 third-level indicators: number of international technology input relationships and number of international technological empowerment relationships. The indicators of previous international study and work experience and international technology input and empowerment relationships are mainly measured using the regional distribution of human capital and technology relationship data of the 2,200 sample enterprises.

### 5. Linkage Capabilities

Connectors are a special kind of innovation entity and activity, which connect various innovation entities including enterprises, developers, universities, non-university scientific research institutes, and governments in order to promote cooperation and exchanges between these various innovative entities. They are the glue and catalyst for smart S&T and economic development. The level of activity of regional connectors often reflects the innovation and development vitality of a region's smart economy. The connectors evaluation indicators include 2 third-level indicators: number of conferences and number of industry alliances. The number of conferences indicator is measured using the number of conferences on smart technology (智能会议)

held in the region, and the industry alliance indicator is measured using the number of regional industry alliances.

### 6. Government Response Capabilities

The government response capabilities indicator measures the government's active fulfillment of its leading and promoting role in the development of the regional AI S&T industry. The government response capabilities indicator includes 2 third-level indicators: number of industrial parks and number of policies issued. The number of industrial parks is measured using the number of AI-related industrial parks planned and constructed by each locality in recent years.

### 7. Data Calculation

The statistical calculation method for the comprehensive score for regional competitiveness in the AI S&T industry includes three steps:

#### (1) Determine Weights for the Indicators at Each Level

This report uses the Analytic Hierarchy Process to calculate the weights of the indicators at each level. The advantage of this approach is that it conforms to systematic principles, is concise and practical, requires less quantitative information, and only requires us to compare indicators at the same level pairwise to obtain the final results. This report uses YAAHP software (version 12.1) to build a hierarchical model and inputs judgment matrices into it. The weight calculation results are shown in Table 2.

Table 2 Consistency Check

| Regional competitive-ness | Enterprise capabilities | Academic ecosystem | Capital environment | International openness | Linkage capabilities | Government response capabilities |
|---|---|---|---|---|---|---|
| 0.0514 | 0.0297 | 0.0351 | 0.0370 | 0.0438 | 0.0000 | 0.0000 |

Indicators at all levels have consistency ratios below 0.1, indicating that they pass the consistency test and the weight settings are reasonable.

#### (2) Standardization

In order to eliminate the dimensional influence of the various indicators, this report uses the minimum-maximum method of the Human Development Index (HDI) of the United Nations Development Programme to standardize each indicator. The formula for calculating the score value of an individual indicator is as follows:

$$X'_{ij} = \frac{X_{ij} - MinX_{ij}}{MaxX_{ij} - MinX_{ij}} \times 100$$

Where, $X_{ij}$ is the score of the jth indicator of the ith region, and $X$ is the indicator value. It must be noted that, according to the calculation method above, the indicator values calculated in this report better represent the relative gaps and rankings of the innovation levels of different regions during the same period.

### (3) Calculate Scores

We calculate the scores of second-level indicators according to the determined weights and individual scores of their third-level indicators and the scores. We calculate the scores of first-level indicators according to the weights of their second-level indicators. We calculate the total score for industry regional competitiveness according to the weights of the first-level indicators. We compiled an indexed ranking of China's new generation AI S&T industry according to these comprehensive scores and sub-indicator scores.

## 02 Overall Evaluation Index for Regional Competitiveness in the AI S&T Industry

### Comprehensive Ranking

Looking at the overall evaluation index of regional competitiveness for China's AI S&T industry in 2022, the six provinces and municipalities of Beijing, Guangdong, Shanghai, Zhejiang, Jiangsu, and Shandong stood in the first rank for AI S&T industry development in China. The comprehensive scores of these six provinces and municipalities we 83.0, 69.5, 33.1, 28.1, 26.5, and 21.4, respectively. Of these regions, the competitive advantages of Beijing and Guangdong are more prominent, and they are far ahead of other provinces and municipalities in China. In addition, Sichuan, Anhui, Liaoning, Hunan, Chongqing, and Hubei held leading positions in the second rank for AI S&T industry development in China, with comprehensive scores of 16.9, 15.4, 15.4, 12.4, 12.3, and 11.7, respectively.

By comparing the comprehensive rankings of provincial and municipal competitiveness in 2021 and 2022, we can see the top ten provinces and municipalities in terms of regional competitiveness in China's AI S&T industry did not change much. Beijing, Guangdong, Shanghai, Zhejiang, Jiangsu, Shandong, Sichuan, Anhui, Liaoning, and Hunan remained in the top ten regions in terms of AI S&T industry competitiveness. Among them, the top eight provinces and municipalities in 2022 were exactly the same as in 2021. However, Liaoning rose one place to 9th in 2022.

For the provinces, municipalities, and autonomous regions ranked 11-20 in 2022, the changes within this group were relatively large. Among them, Chongqing, Hubei, Shaanxi, Shanxi, and Xinjiang increased in rank compared to 2021, Fujian and Tianjin dropped slightly in the rankings, and Henan, Heilongjiang, and Jilin remained stable. Among the provinces, municipalities, and autonomous regions ranked 21-31, Guangxi, Qinghai, and Ningxia saw their rankings increase, Yunnan, Gansu, Inner Mongolia, and Tibet ranked the same as last year, and the rankings of Jiangxi, Hebei, Guizhou, and Hainan fell by varying degrees.

A five-year comparative analysis of the rankings from 2018 to 2022 shows that Beijing, Guangdong, Shanghai, Zhejiang, Jiangsu, and Shandong have consistently ranked among the top ten regions in China. Among these regions, Beijing, Guangdong, Shanghai, Zhejiang, and Jiangsu have always ranked in the top six. Over the past five years, Beijing has ranked first in comprehensive score for regional competitiveness in the AI S&T industry, possessing absolute superiority in the areas of academic ecosystem, capital environment, and international openness. Guangdong has ranked second in the comprehensive rankings for the past five years, possessing absolute superiority in the areas of enterprise capabilities, linkage capabilities, and government

response capabilities. The comprehensive ranking of Shanghai placed 4th in China in 2018. In 2019, its ranking rose to 3rd and has stabilized at that level. Shanghai has comparative advantages in the areas of enterprise capabilities, capital environment, and international openness. Zhejiang ranked 3rd in 2018 and stabilized at 4th from 2019 to 2022. Zhejiang has an advantage in government response capabilities, and it is also in the first rank of regions in terms of enterprise capabilities and international openness.

The comprehensive ranking of Jiangsu has been relatively stable. It ranked 6th in 2020 and has been stable at 5th all other years. Jiangsu has comparative advantages in first-level indicator scores such as government response capabilities, academic ecosystem, linkage capabilities, and capital environment. The comprehensive rankings of Shandong from 2018 to 2022 were 6th, 9th, 5th, 6th, and 6th respectively. In terms of first-level indicators, Shandong is superior in the areas of linkage capabilities, enterprise capabilities, and government response capabilities. In addition, Sichuan, Liaoning, and Hunan ranked among the top ten regions in China in 2019, 2019, and 2020 respectively, and maintained their position over the following years. Over the past five years, Anhui had a relatively stable ranking among the top 10, except when it ranked 12th in 2019.

Table 3 Evaluation Indicator Rankings for Regional Competitiveness in the AI S&T Industry

| Province/Municipality | Comprehensive Ranking (score in parentheses) | | | | |
|---|---|---|---|---|---|
| | 2022 | 2021 | 2020 | 2019 | 2018 |
| Beijing | 1 (83.0) | 1 (82.4) | 1 | 1 | 1 |
| Guangdong | 2 (69.5) | 2 (65.5) | 2 | 2 | 2 |
| Shanghai | 3 (33.1) | 3 (36.0) | 3 | 3 | 4 |
| Zhejiang | 4 (28.1) | 4 (27.6) | 4 | 4 | 3 |
| Jiangsu | 5 (26.5) | 5 (24.4) | 6 | 5 | 5 |
| Shandong | 6 (21.4) | 6 (23.4) | 5 | 9 | 6 |
| Sichuan | 7 (16.9) | 7 (14.8) | 8 | 6 | 11 |
| Anhui | 8 (15.4) | 8 (13.8) | 9 | 12 | 7 |
| Liaoning | 9 (15.4) | 10 (12.2) | 7 | 8 | 13 |
| Hunan | 10 (12.4) | 9 (13.6) | 10 | 13 | 16 |
| Chongqing | 11 (12.3) | 14 (9.9) | 16 | 15 | 12 |
| Hubei | 12 (11.7) | 13 (11.4) | 13 | 7 | 8 |
| Shaanxi | 13 (10.7) | 15 (9.4) | 12 | 11 | 18 |
| Fujian | 14 (10.1) | 12 (11.9) | 15 | 17 | 10 |
| Tianjin | 15 (10.1) | 11 (11.9) | 11 | 10 | 9 |
| Henan | 16 (9.5) | 16 (8.1) | 19 | 18 | 19 |
| Heilongjiang | 17 (8.9) | 17 (8.1) | 14 | 16 | 15 |
| Jilin | 18 (7.1) | 18 (7.9) | 17 | 14 | 20 |
| Shanxi | 19 (6.6) | 22 (4.6) | 21 | 23 | 23 |
| Xinjiang | 20 (6.5) | 24 (3.2) | 24 | 25 | 21 |
| Guangxi | 21 (6.0) | 23 (4.3) | 25 | 26 | 28 |
| Jiangxi | 22 (5.7) | 20 (5.1) | 22 | 22 | 22 |
| Hebei | 23 (5.7) | 19 (6.3) | 18 | 19 | 17 |
| Guizhou | 24 (3.3) | 21 (4.8) | 26 | 21 | 14 |
| Yunnan | 25 (3.0) | 25 (3.2) | 20 | 24 | 25 |
| Gansu | 26 (2.7) | 26 (2.1) | 23 | 20 | 24 |
| Inner Mongolia | 27 (2.3) | 27 (1.2) | 27 | 27 | 26 |
| Qinghai | 28 (0.7) | 29 (0.5) | 29 | 29 | 29 |
| Ningxia | 29 (0.7) | 30 (0.4) | 31 | 29 | 30 |
| Hainan | 30 (0.7) | 28 (0.6) | 28 | 28 | 27 |
| Tibet | 31 (0.4) | 31 (0.1) | 30 | 29 | 31 |

## Evaluation Sub-Indicator Rankings

### 1. Enterprise Capabilities Evaluation Indicator Rankings

In 2022, the top ten regions in terms of enterprise capability evaluation indicator were Guangdong, Beijing, Shanghai, Zhejiang, Shandong, Jiangsu, Liaoning, Anhui,

Hunan, and Chongqing. Their respective enterprise capability evaluation indicator scores were 39.5, 35.7, 15.2, 12.8, 10.4, 8.2, 7.4, 7.4, 5.8, and 4.9.

From 2018 to 2022, Guangdong, Beijing, Shanghai, Zhejiang, Shandong, Jiangsu, and Anhui constantly ranked among the top ten regions in the enterprise capabilities evaluation indicator rankings. Of these regions, the enterprise capability evaluation indicator of Guangdong Province was consistently ranked at or near the top, ranking 2nd in 2018, 2019, and 2020 and rising to 1st in 2021 and 2022. Guangdong has absolute superiority in enterprise valuation and the number of enterprise patents. Beijing's enterprise capability evaluation indicator remained stable in the top two places. Beijing has absolute superiority in number of enterprises, enterprise level, and technological empowerment. Shanghai's enterprise capabilities evaluation indicator ranking rose slightly, from 4th in 2018, 2019, and 2020 to 3rd in 2021 and 2022. Shanghai has clear advantages in number of enterprises and enterprise-level indicators. Zhejiang's enterprise capabilities evaluation indicator ranking has constantly remained among the top rank, with outstanding performance in enterprise valuation and technology empowerment indicators. Shandong ranks high in terms of number of enterprise patents. Jiangsu has comparative advantages in number of enterprises, enterprise valuation, enterprise level, and technological empowerment. Anhui has a relatively prominent advantage in number of enterprise patents.

### 2. Academic Ecosystem Evaluation Indicator Rankings

In 2022, the top ten regions in the academic ecological evaluation indicator rankings were Beijing, Sichuan, Jiangsu, Guangdong, Shanghai, Liaoning, Zhejiang, Shaanxi, Shandong, and Anhui. Their academic ecological evaluation indicator scores were 17.9, 10.1, 9.9, 8.0, 7.9, 7.0, 6.9, 6.8, 6.6, and 6.3, respectively.

From 2018 to 2022, Beijing, Sichuan, Jiangsu, Shanghai, Zhejiang, and Shaanxi constantly ranked among the top ten regions in the academic ecosystem evaluation indicator rankings. Among these regions, Beijing's academic ecosystem evaluation indicator has always remained in 1st place, and it has an absolute superiority in the indicators of number of institutions and the average number of international research papers. Sichuan's academic ecosystem evaluation indicator ranking has shown a significant upward trend, and it has prominent advantages in average number of international research papers and average number of patents. Jiangsu's academic ecosystem evaluation indicator ranking has constantly remained in the top three, and it has absolute superiority in number of AI universities and a clear advantage in average number of patents. Shanghai's academic ecosystem evaluation indicator ranking has constantly remained in the top five, and it has relatively prominent advantages in number of institutions and clear advantages in number of AI universities and average

number of international research papers. Zhejiang has prominent advantages in number of institutions and has clear advantages in the indicators of the average number of patents and the average number of international papers. Shaanxi has prominent advantages in average number of international research papers, and has clear advantages in number of institutions.

Table 4 Enterprise Capabilities Evaluation Indicator Rankings

| Province/Municipality | Enterprise Capabilities Evaluation Indicator Rankings (score in parentheses) | | | | |
|---|---|---|---|---|---|
| | 2022 | 2021 | 2020 | 2019 | 2018 |
| Guangdong | 1 (39.5) | 1 (37.7) | 2 | 2 | 2 |
| Beijing | 2 (35.7) | 2 (31.6) | 1 | 1 | 1 |
| Shanghai | 3 (15.2) | 3 (15.4) | 4 | 4 | 4 |
| Zhejiang | 4 (12.8) | 5 (12.5) | 5 | 3 | 3 |
| Shandong | 5 (10.4) | 4 (13.9) | 3 | 8 | 5 |
| Jiangsu | 6 (8.2) | 6 (7.4) | 6 | 5 | 7 |
| Liaoning | 7 (7.4) | 11 (4.6) | 9 | 15 | 10 |
| Anhui | 8 (7.4) | 9 (6.3) | 10 | 10 | 6 |
| Hunan | 9 (5.8) | 7 (7.4) | 7 | 12 | 13 |
| Chongqing | 10 (4.9) | 13 (3.7) | 16 | 14 | 12 |
| Fujian | 11 (4.6) | 8 (6.7) | 8 | 11 | 8 |
| Xinjiang | 12 (4.6) | 24 (0.7) | 20 | 20 | 18 |
| Sichuan | 13 (4.5) | 14 (3.6) | 12 | 9 | 9 |
| Henan | 14 (4.2) | 15 (2.4) | 19 | 16 | 19 |
| Shanxi | 15 (3.8) | 19 (2.0) | 15 | 22 | 17 |
| Hubei | 16 (3.7) | 12 (4.3) | 13 | 6 | 11 |
| Shaanxi | 17 (2.6) | 21 (1.3) | 17 | 13 | 19 |
| Guangxi | 18 (2.4) | 23 (0.7) | 23 | 23 | 19 |
| Tianjin | 19 (2.4) | 10 (5.3) | 11 | 7 | 15 |
| Jilin | 20 (2.0) | 17 (2.1) | 23 | 23 | 19 |
| Heilongjiang | 21 (2.0) | 20 (2.0) | 14 | 21 | 16 |
| Jiangxi | 22 (1.9) | 22 (1.3) | 23 | 23 | 19 |
| Hebei | 23 (1.7) | 18 (2.1) | 18 | 17 | 19 |
| Guizhou | 24 (1.3) | 16 (2.2) | 21 | 19 | 14 |
| Tibet | 25 (0.3) | 30 (0.0) | 23 | 24 | 22 |
| Yunnan | 26 (0.3) | 27 (0.2) | 23 | 23 | 19 |
| Inner Mongolia | 27 (0.1) | 28 (0.1) | 23 | 23 | 19 |
| Ningxia | 28 (0.1) | 25 (0.3) | 23 | 24 | 21 |
| Hainan | 29 (0.1) | 26 (0.3) | 22 | 18 | 19 |
| Gansu | 30 (0.1) | 29 (0.0) | 23 | 23 | 19 |
| Qinghai | 31 (0.0) | 31 (0.0) | 23 | 24 | 20 |

Table 5 Academic Ecosystem Evaluation Indicator Rankings

| Province/Municipality | Academic Ecosystem Evaluation Indicator Rankings (score in parentheses) | | | | |
|---|---|---|---|---|---|
| | 2022 | 2021 | 2020 | 2019 | 2018 |
| Beijing | 1 (17.9) | 1 (18.4) | 1 | 1 | 1 |
| Sichuan | 2 (10.1) | 3 (9.4) | 9 | 7 | 5 |
| Jiangsu | 3 (9.9) | 2 (9.7) | 2 | 3 | 2 |
| Guangdong | 4 (8.0) | 7 (7.0) | 6 | 5 | 13 |
| Shanghai | 5 (7.9) | 4 (7.7) | 3 | 2 | 3 |
| Liaoning | 6 (7.0) | 9 (6.5) | 8 | 4 | 11 |
| Zhejiang | 7 (6.9) | 5 (7.3) | 4 | 9 | 9 |
| Shaanxi | 8 (6.8) | 6 (7.2) | 5 | 6 | 6 |
| Shandong | 9 (6.6) | 8 (6.6) | 11 | 16 | 16 |
| Anhui | 10 (6.3) | 11 (5.5) | 13 | 12 | 15 |
| Chongqing | 11 (6.1) | 16 (4.1) | 15 | 10 | 10 |
| Heilongjiang | 12 (5.8) | 10 (5.8) | 10 | 13 | 7 |
| Hubei | 13 (5.8) | 12 (5.5) | 12 | 14 | 4 |
| Tianjin | 14 (5.3) | 14 (4.9) | 14 | 15 | 12 |
| Hunan | 15 (4.6) | 15 (4.3) | 16 | 11 | 8 |
| Jilin | 16 (4.4) | 13 (5.3) | 7 | 8 | 14 |
| Henan | 17 (4.2) | 17 (4.1) | 20 | 19 | 19 |
| Fujian | 18 (3.2) | 18 (3.0) | 18 | 18 | 20 |
| Jiangxi | 19 (3.0) | 19 (2.8) | 22 | 21 | 18 |
| Guangxi | 20 (2.9) | 21 (2.8) | 25 | 27 | 24 |
| Hebei | 21 (2.8) | 20 (2.8) | 19 | 20 | 24 |
| Yunnan | 22 (2.4) | 22 (2.5) | 17 | 23 | 22 |
| Shanxi | 23 (2.1) | 24 (2.0) | 23 | 22 | 21 |
| Xinjiang | 24 (1.7) | 23 (2.4) | 24 | 26 | 23 |
| Guizhou | 25 (1.7) | 25 (1.7) | 25 | 24 | 24 |
| Gansu | 26 (1.6) | 26 (1.6) | 21 | 17 | 17 |
| Inner Mongolia | 27 (1.1) | 27 (0.8) | 25 | 25 | 24 |
| Qinghai | 28 (0.4) | 28 (0.4) | 25 | 29 | 25 |
| Hainan | 29 (0.0) | 29 (0.0) | 25 | 28 | 24 |
| Ningxia | 29 (0.0) | 29 (0.0) | 25 | 29 | 26 |
| Tibet | 29 (0.0) | 29 (0.0) | 25 | 29 | 27 |

### 3. Capital Environment Evaluation Indicator Rankings

In 2022, the top ten regions in the capital environment evaluation indicator rankings were Beijing, Guangdong, Shanghai, Jiangsu, Zhejiang, Tianjin, Shandong, Fujian, Sichuan, and Hubei. Their capital environment evaluation indicator scores were 18.7, 8.0, 5.0, 2.8, 2.6, 1.3, 0.8, 0.8, 0.6, and 0.5 respectively.

From 2018 to 2022, Beijing, Guangdong, Shanghai, Jiangsu, Zhejiang, and Shandong constantly ranked among the top ten regions in the capital environment evaluation indicator rankings. Among these regions, Beijing's capital environment evaluation indicator score has constantly put it in 1st place. It has absolute superiority in indicators such as number of investment relationships, number of financing relationships, and amount of financing. Guangdong's capital environment evaluation indicator ranking rose slightly, from 4th in 2018, 2019, and 2020 to 2nd in 2021 and 2022. It has clear advantages in terms of number of investment relationships, number of financing relationships, and amount of financing. Shanghai's capital environment evaluation indicator ranking has always remained within the top three positions. It has clear advantages in terms of number of investment relationships, number of financing relationships, and amount of financing. Jiangsu's capital environment evaluation indicator ranking maintained a slight upward trend, rising from 5th in 2018, 2019, 2020, and 2021 to 4th in 2022. It has relatively prominent advantages in terms of number of investment relationships and amount of financing. Zhejiang's capital environment evaluation indicator ranking has always remained within the top five positions. It has prominent advantages in terms of number of financing relationships and clear advantages in terms of number of investment relationships. Shandong's capital environment evaluation indicator ranking has always remained within the top ten positions. It has comparative advantages in terms of number of investment relationships and number of financing relationships.

### 4. International Openness Evaluation Indicator Rankings

Looking at the international openness evaluation indicator rankings for 2022, the top ten regions are Beijing, Guangdong, Shanghai, Zhejiang, Jiangsu, Sichuan, Fujian, Hubei, Tianjin, and Shandong, with scores of 7.7, 6.1, 3.1, 2.1, 0.9, 0.3, 0.3, 0.2, 0.2, and 0.2 respectively.

From 2018 to 2022, Beijing, Guangdong, Shanghai, Zhejiang, Jiangsu, and Fujian remained in the top ten. Beijing's ranking has never moved from 1st, and Guangdong's ranking rose from 3rd to 2nd in 2020, and it has kept this rank up to now. The rankings of Shanghai and Zhejiang have fluctuated slightly, but they have constantly remained

in the top four and are among the Chinese provinces and municipalities with a high degree of openness.

In terms of specific third-level indicators, Beijing has absolute superiority in previous international study experience, previous international work experience, and number of international technology input relationships. Guangdong ranks 1st in number of international technological empowerment relationships. Shenzhen ranks 1st in average enterprise valuation. Shanghai, Zhejiang, and Jiangsu had balanced performance for all the third-level indicators, which had a high degree of consistency with the first-level indicator rankings of their respective regions. Fujian Province has comparative advantages in the two third-level indicators of previous international study experience and previous international work experience. In 2022, Fujian Province ranked 8th in the international openness ranking index, but it ranked 6th in both previous international study experience and previous international work experience.

Table 6 Capital Environment Evaluation Indicator Rankings

| Province/Municipality | Capital Environment Evaluation Indicator Rankings (score in parentheses) | | | | |
|---|---|---|---|---|---|
| | 2022 | 2021 | 2020 | 2019 | 2018 |
| Beijing | 1 (18.7) | 1 (18.6) | 1 | 1 | 1 |
| Guangdong | 2 (8.0) | 2 (7.3) | 4 | 4 | 4 |
| Shanghai | 3 (5.0) | 3 (6.3) | 2 | 2 | 2 |
| Jiangsu | 4 (2.8) | 5 (2.7) | 5 | 5 | 5 |
| Zhejiang | 5 (2.6) | 4 (2.7) | 3 | 3 | 3 |
| Tianjin | 6 (1.3) | 12 (0.3) | 7 | 7 | 6 |
| Shandong | 7 (0.8) | 8 (0.6) | 9 | 6 | 9 |
| Fujian | 8 (0.8) | 6 (0.8) | 6 | 10 | 14 |
| Sichuan | 9 (0.6) | 9 (0.4) | 12 | 12 | 16 |
| Hubei | 10 (0.5) | 7 (0.6) | 8 | 8 | 15 |
| Anhui | 11 (0.3) | 10 (0.3) | 10 | 11 | 8 |
| Hunan | 12 (0.3) | 11 (0.3) | 13 | 9 | 13 |
| Gansu | 13 (0.3) | 29 (0.0) | 23 | 22 | 17 |
| Jilin | 14 (0.3) | 25 (0.0) | 23 | 22 | 17 |
| Liaoning | 15 (0.2) | 13 (0.3) | 11 | 14 | 7 |
| Chongqing | 16 (0.2) | 14 (0.2) | 14 | 15 | 11 |
| Hebei | 17 (0.2) | 16 (0.1) | 20 | 17 | 17 |
| Jiangxi | 18 (0.2) | 19 (0.1) | 23 | 22 | 9 |
| Guizhou | 19 (0.1) | 15 (0.2) | 15 | 13 | 12 |
| Heilongjiang | 20 (0.1) | 22 (0.1) | 17 | 22 | 17 |
| Xinjiang | 21 (0.1) | 21 (0.1) | 19 | 18 | 17 |
| Shaanxi | 22 (0.1) | 17 (0.1) | 16 | 16 | 17 |
| Henan | 23 (0.1) | 18 (0.1) | 22 | 21 | 17 |
| Hainan | 24 (0.1) | 20 (0.1) | 21 | 20 | 17 |
| Tibet | 25 (0.1) | 29 (0.0) | 23 | 23 | 20 |
| Guangxi | 26 (0.0) | 23 (0.0) | 23 | 22 | 17 |
| Inner Mongolia | 27 (0.0) | 28 (0.0) | 23 | 22 | 17 |
| Shanxi | 28 (0.0) | 24 (0.0) | 18 | 19 | 17 |
| Yunnan | 29 (0.0) | 26 (0.0) | 23 | 22 | 17 |
| Ningxia | 30 (0.0) | 27 (0.0) | 23 | 23 | 19 |
| Qinghai | 31 (0.0) | 29 (0.0) | 23 | 23 | 18 |

## Table 7 International Openness Evaluation Indicator Rankings

| Province/Municipality | International Openness Evaluation Indicator Rankings (score in parentheses) | | | | |
|---|---|---|---|---|---|
| | 2022 | 2021 | 2020 | 2019 | 2018 |
| Beijing | 1 (7.7) | 1 (7.7) | 1 | 1 | 1 |
| Guangdong | 2 (6.1) | 2 (6.6) | 2 | 3 | 3 |
| Shanghai | 3 (3.1) | 3 (3.2) | 4 | 4 | 2 |
| Zhejiang | 4 (2.1) | 4 (2.1) | 3 | 2 | 4 |
| Jiangsu | 5 (0.9) | 5 (0.9) | 5 | 7 | 5 |
| Sichuan | 6 (0.3) | 9 (0.2) | 11 | 15 | 14 |
| Fujian | 7 (0.3) | 7 (0.2) | 10 | 6 | 7 |
| Hubei | 8 (0.2) | 6 (0.2) | 15 | 14 | 6 |
| Tianjin | 9 (0.2) | 12 (0.2) | 7 | 9 | 8 |
| Shandong | 10 (0.2) | 11 (0.2) | 12 | 8 | 10 |
| Liaoning | 11 (0.2) | 8 (0.2) | 6 | 10 | 15 |
| Anhui | 12 (0.2) | 10 (0.2) | 9 | 5 | 11 |
| Chongqing | 13 (0.1) | 13 (0.1) | 8 | 11 | 9 |
| Hunan | 14 (0.1) | 14 (0.1) | 14 | 12 | 12 |
| Xinjiang | 15 (0.1) | 23 (0.0) | 16 | 17 | 17 |
| Henan | 16 (0.1) | 19 (0.0) | 16 | 17 | 17 |
| Guizhou | 17 (0.1) | 15 (0.1) | 16 | 17 | 16 |
| Hebei | 18 (0.1) | 16 (0.0) | 16 | 16 | 17 |
| Guangxi | 19 (0.0) | 17 (0.0) | 16 | 17 | 17 |
| Hainan | 20 (0.0) | 18 (0.0) | 16 | 13 | 17 |
| Shaanxi | 21 (0.0) | 20 (0.0) | 13 | 17 | 13 |
| Jiangxi | 22 (0.0) | 25 (0.0) | 16 | 17 | 17 |
| Heilongjiang | 23 (0.0) | 21 (0.0) | 16 | 17 | 17 |
| Jilin | 24 (0.0) | 22 (0.0) | 16 | 17 | 17 |
| Inner Mongolia | 25 (0.0) | 27 (0.0) | 16 | 17 | 17 |
| Tibet | 25 (0.0) | 27 (0.0) | 16 | 18 | 20 |
| Ningxia | 27 (0.0) | 23 (0.0) | 16 | 18 | 19 |
| Shanxi | 28 (0.0) | 26 (0.0) | 16 | 17 | 17 |
| Yunnan | 29 (0.0) | 27 (0.0) | 16 | 17 | 17 |
| Gansu | 29 (0.0) | 27 (0.0) | 16 | 17 | 17 |
| Qinghai | 29 (0.0) | 27 (0.0) | 16 | 18 | 18 |

## 5. Linkage Capabilities Evaluation Indicator Rankings

Looking at the linkage capabilities evaluation indicator rankings for 2022, the top ten regions are Guangdong, Shandong, Jiangsu, Beijing, Zhejiang, Sichuan, Fujian, Hubei, Shanghai, and Hunan, with scores of 4.6, 2.6, 2.5, 2.3, 1.9, 1.1, 1.1, 1.1, 1.0, and 1.0 respectively.

From 2018 to 2022, the regions Guangdong, Shandong, Jiangsu, Beijing, Zhejiang, and Shanghai were consistently in the top ten. Specifically, Guangdong remained in 2nd place in the first four years and rose to 1st place in 2022. Shandong's ranking fluctuated greatly, but its growth rate was amazing. In the first four years, it ranked 5th or lower, before suddenly surging to 2nd place in China in 2022. Jiangsu has made steady progress in the rankings, gradually rising from 5th to 4th, and then to 3rd this year. Beijing's ranking declined, falling from 1st in the first four years to 4th this year. Zhejiang's ranking did not change much, holding steady at 4th and 5th place.

In terms of specific third-level indicators, Guangdong ranks 1st nationwide in the number of AI industry alliances. Shandong also ranks among the top in number of industry alliances. Jiangsu's strength is balanced in terms of number of industrial alliances and number of conferences. Beijing has absolute superiority in number of conferences, ranking 1st nationwide. Zhejiang has a comparative advantage in number of industrial alliances. Shanghai ranks 1st in number of AI conferences.

## 6. Government Response Capabilities Evaluation Indicator Rankings

Looking at government response capabilities evaluation indicator rankings for 2022, the top ten regions are Guangdong, Jiangsu, Zhejiang, Shanghai, Shandong, Beijing, Chongqing, Tianjin, Hunan, and Gansu, with scores of 3.2, 2.2, 1.7, 0.8, 0.7, 0.7, 0.6, 0.6, 0.6, and 0.5 respectively.

From 2018 to 2022, the regions Guangdong, Jiangsu, Zhejiang, Shanghai, Shandong, and Beijing were consistently in the top ten. Specifically, the regions Guangdong, Jiangsu, Zhejiang, and Shanghai have not changed much overall, but Shandong rose from 9th place in 2018 to 5th place this year. Beijing's ranking has fluctuated, but it still ranks near the top.

In terms of specific third-level indicators, Guangdong ranks 1st in the number of AI industrial parks. Jiangsu has also shown outstanding performance in the construction of industrial parks and ranks near the top. Zhejiang has shown an absolute superiority in number of policies issued. Shanghai is strong in terms of number of industrial parks, but it needs to further improve in the area of policy issuance. Beijing has a comparative advantage in number of industrial parks.

## Table 8 Linkage Capabilities Evaluation Indicator Rankings

| Province/Municipality | Linkage Capabilities Evaluation Indicator Rankings (score in parentheses) | | | | |
|---|---|---|---|---|---|
| | 2022 | 2021 | 2020 | 2019 | 2018 |
| Guangdong | 1 (4.6) | 2 (3.6) | 2 | 2 | 2 |
| Shandong | 2 (2.6) | 7 (0.8) | 5 | 6 | 8 |
| Jiangsu | 3 (2.5) | 4 (1.4) | 4 | 5 | 5 |
| Beijing | 4 (2.3) | 1 (5.1) | 1 | 1 | 1 |
| Zhejiang | 5 (1.9) | 5 (1.2) | 6 | 4 | 4 |
| Sichuan | 6 (1.1) | 9 (0.6) | 11 | 11 | 12 |
| Fujian | 7 (1.1) | 10 (0.6) | 15 | 15 | 20 |
| Hubei | 8 (1.1) | 17 (0.2) | 14 | 14 | 9 |
| Shanghai | 9 (1.0) | 3 (2.3) | 3 | 3 | 3 |
| Hunan | 10 (1.0) | 8 (0.7) | 10 | 9 | 14 |
| Anhui | 11 (0.9) | 12 (0.5) | 8 | 7 | 11 |
| Shaanxi | 12 (0.8) | 16 (0.2) | 17 | 17 | 14 |
| Hebei | 13 (0.7) | 14 (0.4) | 13 | 25 | 23 |
| Heilongjiang | 14 (0.7) | 19 (0.1) | 16 | 13 | 10 |
| Henan | 15 (0.6) | 13 (0.5) | 12 | 12 | 13 |
| Inner Mongolia | 16 (0.6) | 26 (0.0) | 24 | 22 | 23 |
| Shanxi | 17 (0.5) | 18 (0.2) | 19 | 16 | 17 |
| Liaoning | 18 (0.5) | 15 (0.3) | 20 | 20 | 17 |
| Hainan | 19 (0.4) | 25 (0.0) | 25 | 23 | 21 |
| Jiangxi | 20 (0.4) | 19 (0.1) | 22 | 18 | 23 |
| Tianjin | 21 (0.4) | 11 (0.5) | 9 | 8 | 7 |
| Jilin | 22 (0.3) | 23 (0.0) | 23 | 20 | 17 |
| Chongqing | 23 (0.3) | 6 (0.9) | 7 | 10 | 6 |
| Ningxia | 24 (0.3) | 28 (0.0) | 27 | 28 | 25 |
| Guangxi | 25 (0.3) | 27 (0.0) | 21 | 26 | 23 |
| Gansu | 26 (0.2) | 23 (0.0) | 27 | 27 | 23 |
| Yunnan | 27 (0.2) | 22 (0.1) | 26 | 24 | 21 |
| Guizhou | 28 (0.1) | 21 (0.1) | 18 | 18 | 14 |
| Qinghai | 29 (0.1) | 29 (0.0) | 29 | 28 | 24 |
| Xinjiang | 30 (0.1) | 29 (0.0) | 29 | 27 | 23 |
| Tibet | 31 (0.0) | 29 (0.0) | 29 | 28 | 26 |

Table 9 Government Response Capabilities Evaluation Indicator Rankings

| Province/Municipality | Government Response Capabilities Evaluation Indicator Rankings (score in parentheses) | | | | |
|---|---|---|---|---|---|
| | 2022 | 2021 | 2020 | 2019 | 2018 |
| Guangdong | 1 (3.2) | 1 (3.2) | 1 | 1 | 2 |
| Jiangsu | 2 (2.2) | 2 (2.3) | 2 | 2 | 1 |
| Zhejiang | 3 (1.7) | 3 (1.8) | 4 | 3 | 3 |
| Shanghai | 4 (0.8) | 4 (1.3) | 6 | 5 | 4 |
| Shandong | 5 (0.7) | 5 (1.3) | 3 | 7 | 9 |
| Beijing | 6 (0.7) | 8 (0.9) | 10 | 10 | 5 |
| Chongqing | 7 (0.6) | 10 (0.8) | 9 | 18 | 12 |
| Tianjin | 8 (0.6) | 14 (0.7) | 15 | 11 | 7 |
| Hunan | 9 (0.6) | 12 (0.8) | 13 | 15 | 21 |
| Gansu | 10 (0.5) | 21 (0.4) | 22 | 17 | 24 |
| Hubei | 11 (0.4) | 16 (0.6) | 14 | 8 | 9 |
| Inner Mongolia | 12 (0.4) | 25 (0.2) | 26 | 26 | 23 |
| Heilongjiang | 13 (0.4) | 26 (0.2) | 27 | 27 | 18 |
| Shaanxi | 14 (0.4) | 19 (0.5) | 17 | 22 | 21 |
| Anhui | 15 (0.4) | 7 (0.9) | 5 | 6 | 6 |
| Sichuan | 16 (0.4) | 15 (0.6) | 11 | 16 | 12 |
| Henan | 17 (0.3) | 6 (0.9) | 8 | 9 | 16 |
| Guangxi | 18 (0.3) | 13 (0.7) | 12 | 12 | 24 |
| Hebei | 19 (0.3) | 9 (0.8) | 7 | 4 | 8 |
| Ningxia | 20 (0.3) | 31 (0.0) | 31 | 29 | 26 |
| Qinghai | 21 (0.3) | 29 (0.1) | 29 | 29 | 25 |
| Fujian | 22 (0.2) | 17 (0.5) | 20 | 18 | 18 |
| Jiangxi | 23 (0.2) | 11 (0.8) | 16 | 14 | 15 |
| Hainan | 24 (0.1) | 27 (0.1) | 28 | 28 | 24 |
| Shanxi | 25 (0.1) | 24 (0.3) | 24 | 25 | 24 |
| Jilin | 26 (0.1) | 22 (0.4) | 23 | 23 | 18 |
| Liaoning | 27 (0.1) | 23 (0.3) | 19 | 13 | 12 |
| Tibet | 28 (0.1) | 30 (0.1) | 30 | 29 | 27 |
| Yunnan | 29 (0.1) | 20 (0.4) | 18 | 24 | 24 |
| Xinjiang | 30 (0.0) | 28 (0.1) | 25 | 20 | 16 |
| Guizhou | 31 (0.0) | 18 (0.5) | 21 | 21 | 11 |

## 03 Evaluation Index Rankings for Regional Competitiveness in the AI S&T Industry for the Four Major Economic Circles

### Comprehensive Ranking

Table 10 Evaluation Index Rankings for Regional Competitiveness in the AI S&T Industry for the Four Major Economic Circles

| Economic Circle | Comprehensive Ranking (score in parentheses) | | | | |
|---|---|---|---|---|---|
| | 2022 | 2021 | 2020 | 2019 | 2018 |
| Yangtze Delta | 1 (103.0) | 1 (101.9) | 2 | 2 | 2 |
| Beijing-Tianjin-Hebei | 2 (98.7) | 2 (100.5) | 1 | 1 | 1 |
| Pearl River Delta | 3 (69.5) | 3 (65.5) | 3 | 3 | 3 |
| Sichuan-Chongqing | 4 (29.2) | 4 (24.7) | 4 | 4 | 4 |

According to the rankings of the 6 first-level indicators of enterprise capabilities, academic ecosystem, capital environment, international openness, linkage capabilities, and government response capabilities, this report conducted a comprehensive evaluation of the regional competitiveness in the AI S&T industry among the four major economic circles (经济圈). Table 10 lists the overall scores and rankings of the four major economic circles. The Yangtze River Delta region has a total score of 103.0 points, ranking 1st among the four major economic circles, while the Beijing-Tianjin-Hebei region ranked 2nd with 98.7 points, the Pearl River Delta region ranked 3rd with 69.5 points, and the Sichuan-Chongqing region ranked 4th with 29.2 points. We can see that the comprehensive rankings of the four major economic circles have not changed from 2021, and the regional competitiveness pattern has a trend of stability.

Looking at the changes in the comprehensive rankings of the four major economic circles from 2018 to 2022, the Pearl River Delta and Sichuan-Chongqing regions have consistently remained in 3rd and 4th place. In comparison, the competition between the 1st and 2nd place regions in the overall rankings has been fierce. The Beijing-Tianjin-Hebei region and the Yangtze River Delta region exchanged places in the regional competitiveness rankings after 2020, with the Yangtze River Delta rising from 2nd place to 1st place. Looking at the overall scores for the 6 first-level indicators, the distribution of AI enterprises in the Yangtze River Delta region is more scattered than in the Beijing-Tianjin-Hebei region. In order to promote economic transformation and development through digitalization and intelligentization (智能化), many economically developed prefecture-level cities in the Yangtze River Delta region have introduced AI-related policies and plans and built AI industrial parks in succession, so that the region

is ranked 1st among the four major economic circles in terms of government policy response capabilities. In addition, the Yangtze River Delta now pays more attention to the stable improvement of its international openness and linkage capabilities, and has risen in the rankings for both indicators compared to 2021.

The comprehensive score of the Beijing-Tianjin-Hebei region is not much different from that of the Yangtze River Delta region. This region ranks first among the four major economic circles in terms of capital environment and international openness and second in both enterprise capabilities and academic ecosystem. It is the region with the most complete and dynamic innovation ecosystem. The government response capabilities indicator for the Beijing-Tianjin-Hebei region ranks 3rd among the four major economic circles.

The Pearl River Delta region ranks 3rd in terms of international openness, down one place from 2021, and ranks second in terms of government response capabilities. It has room for improvement in the other 4 first-level indicators, especially in terms of academic ecosystem, where the Pearl River Delta region scored lower than the Beijing-Tianjin-Hebei, Yangtze River Delta, and Sichuan-Chongqing regions. Compared with the Beijing-Tianjin-Hebei, Yangtze River Delta, and Sichuan-Chongqing regions, its academic ecosystem is a key factor restricting the development of the AI S&T industry in the Pearl River Delta region.

As the gathering place for the AI S&T industry in western China, the Sichuan-Chongqing region has been increasing efforts to develop its digital economy and AI S&T industry in recent years. Its main advantage lies in its relatively good academic ecosystem foundation (behind only the Beijing-Tianjin-Hebei and Yangtze River Delta regions, and better than the Pearl River Delta region). Compared with the other three economic circles, the Sichuan-Chongqing economic circle needs to enhance its enterprise capabilities, capital environment, international openness, linkage capabilities, and government response capabilities.

## Evaluation Sub-Indicator Rankings

### 1. Enterprise Capabilities Evaluation Indicator Rankings

Table 11 AI S&T Industry Enterprise Capabilities Evaluation Indicator Rankings for the Four Major Economic Circles

| Province/Municipality | Enterprise Capabilities Evaluation Indicator Rankings (score in parentheses) | | | | |
|---|---|---|---|---|---|
| | 2022 | 2021 | 2020 | 2019 | 2018 |
| Yangtze Delta | 1 (43.6) | 1 (41.6) | 3 | 2 | 3 |
| Beijing-Tianjin-Hebei | 2 (39.7) | 2 (39.0) | 1 | 1 | 1 |
| Pearl River Delta | 3 (39.5) | 3 (37.3) | 2 | 3 | 2 |
| Sichuan-Chongqing | 4 (9.4) | 4 (7.3) | 4 | 4 | 4 |

In terms of enterprise capabilities indicator rankings, the Yangtze River Delta region ranked 1st with a score of 43.6, the Beijing-Tianjin-Hebei region ranked 2nd with a score of 39.7, and the Pearl River Delta region ranked 3rd with a score of 39.5. Compared with other economic circles, the Sichuan-Chongqing region lagged far behind in this indicator, with a score of only 9.4. Compared with the 2021 enterprise capabilities indicator rankings, the rankings of each region did not change in 2022.

The enterprise capability evaluation indicator consists of two second-level indicators: enterprise scale and enterprise innovation capabilities. Of these, the second-level enterprise scale indicator consists of 2 third-level indicators: number of AI enterprises and the enterprise valuation/market capitalization. The second-level enterprise innovation capabilities indicator contains three third-level indicators: average number of enterprise patents, number of basic and technology level enterprises, and number of technological empowerment relationships. Looking at the sub-indicator rankings, Beijing-Tianjin-Hebei has maintained a relative superiority in number of basic and technology level enterprises, ranking 1st in this indicator for many years. It has cumulative advantages in terms of the number of enterprises and number of technological empowerment relationships, but was slightly weaker in 2021 when it dropped from 1st to 2nd place. In terms of enterprise valuation/market capitalization, it ranked 1st for two consecutive years in 2020 and 2021, but the Pearl River Delta region took 1st place for this indicator in 2022. The Pearl River Delta ranked 1st in terms of average number of enterprise patents until 2022, when the Yangtze River Delta took 1st place in this indicator. The Sichuan-Chongqing region is in a relatively backward position in the annual statistics for a number of enterprise capabilities third-level indicators.

## 2. Academic Ecosystem Evaluation Indicator Rankings

Table 12 AI S&T Industry Academic Ecosystem Evaluation Indicator Rankings for the Four Major Economic Circles

| Province/Municipality | Academic Ecosystem Evaluation Indicator Rankings (score in parentheses) | | | | |
|---|---|---|---|---|---|
| | 2022 | 2021 | 2020 | 2019 | 2018 |
| Yangtze Delta | 1 (31.0) | 1 (30.2) | 1 | 2 | 2 |
| Beijing-Tianjin-Hebei | 2 (26.0) | 2 (26.1) | 2 | 1 | 1 |
| Sichuan-Chongqing | 3 (16.2) | 3 (13.5) | 3 | 3 | 4 |
| Pearl River Delta | 4 (8.0) | 4 (7.0) | 4 | 4 | 3 |

In terms of academic ecosystem indicator rankings, the Yangtze River Delta region ranked 1st with a score of 31.0, the Beijing-Tianjin-Hebei region ranked 2nd with a score of 26.0, the Sichuan-Chongqing region ranked 3rd with a score of 16.2, and the Pearl River Delta region ranked 4th with a score of 8.0. Compared with other regions, the Pearl River Delta region was slightly weaker in terms of academic ecosystem. Compared with 2021, the academic ecosystem indicator rankings of the four major economic circles have not changed.

The 2 second-level indicators of the academic ecosystem indicator are AI university innovation capabilities and non-university scientific research institute innovation capabilities. Of these, the AI university innovation capabilities second-level indicator includes 4 third-level indicators: number of AI universities, average number of domestic research papers, average number of international research papers, and average number of patents. Looking at the ranking of the third-level indicators of AI university innovation capabilities, the Yangtze River Delta has maintained a relative lead in number of AI universities and average number of patents, ranking 1st for many years. It has certain advantages in average number of domestic and international research papers, and after years of hard work, it reached 1st place in these two indicators in 2021.

The second-level indicator non-university scientific research institute innovation capabilities includes 4 third-level indicators: number of institutes, average number of domestic research papers, average number of international research papers, and average number of patents. Looking at its rankings in the third-level indicator of non-university scientific research institute innovation capabilities, the overall performance of the Beijing-Tianjin-Hebei region is relatively good, ranking first in number of institutes. At the same time, the region also ranks near the top in average number of domestic research papers and average number of international research papers.

### 3. Capital Environment Evaluation Indicator Rankings

Table 13 AI S&T Industry Capital Environment Evaluation Indicator Rankings for the Four Major Economic Circles

| Province/Municipality | Capital Environment Evaluation Indicator Rankings (score in parentheses) | | | | |
|---|---|---|---|---|---|
| | 2022 | 2021 | 2020 | 2019 | 2018 |
| Beijing-Tianjin-Hebei | 1 (20.1) | 1 (19.0) | 1 | 1 | 1 |
| Yangtze Delta | 2 (10.7) | 2 (12.1) | 2 | 2 | 2 |
| Pearl River Delta | 3 (8.0) | 3 (7.3) | 3 | 3 | 3 |
| Sichuan-Chongqing | 4 (0.8) | 4 (0.6) | 4 | 4 | 4 |

In terms of capital environment indicator rankings, the Beijing-Tianjin-Hebei region ranked 1st with a score of 20.1, the Yangtze River Delta region ranked 2nd with a score of 10.7, the Pearl River Delta region ranked 3rd with a score of 8.0, and the Sichuan-Chongqing region ranked 4th with a score of 0.8. Looking at the rankings over the years, the capital environment competition pattern of the four major economic circles has remained relatively stable.

The capital environment indicator has 2 second-level indicators, financing and investment. The investment second-level indicator includes 1 third-level indicator: number of investment relationships. The financing second-level indicator includes 2 third-level indicators: number of financing relationships and amount of financing. Looking at the sub-indicator rankings, Beijing-Tianjin-Hebei maintains a relative lead in number of investment relationships, number of financing relationships, and amount of financing, ranking 1st in these indicators for many years. In the third-level indicators established under capital environment, the rankings of the four major economic circles have remained basically unchanged over the years.

## 4. International Openness Evaluation Indicator Rankings

Table 14 AI S&T Industry International Openness Evaluation Indicator Rankings for the Four Major Economic Circles

| Province/Municipality | International Openness Evaluation Indicator Rankings (score in parentheses) | | | | |
|---|---|---|---|---|---|
| | 2022 | 2021 | 2020 | 2019 | 2018 |
| Beijing-Tianjin-Hebei | 1 (8.0) | 1 (7.9) | 1 | 1 | 1 |
| Yangtze Delta | 2 (6.3) | 3 (6.4) | 2 | 2 | 2 |
| Pearl River Delta | 3 (6.1) | 2 (6.6) | 3 | 3 | 3 |
| Sichuan-Chongqing | 4 (0.4) | 4 (0.4) | 4 | 4 | 4 |

In terms of the international openness indicator rankings, the Beijing-Tianjin-Hebei region ranked 1st with a score of 8.0, the Yangtze River Delta region ranked 2nd with a score of 6.3, the Pearl River Delta region ranked 3rd with a score of 6.1, and the Sichuan-Chongqing region ranked 4th with a score of 0.4. Compared with the other regions, the Sichuan-Chongqing region is at a disadvantage in terms of international openness. The competitive pattern of the four major economic circles in terms of international openness has remained relatively stable. In 2021, the Yangtze River Delta region and the Pearl River Delta region exchanged 2nd and 3rd place, but their overall rankings returned to the previous state in 2022.

The international openness evaluation indicator consists of 2 second-level indicators: core human capital openness and technology openness. Of these, the core human capital openness second-level indicator includes 2 third-level indicators: previous international study experience and previous international work experience. The technology openness second-level indicator includes 2 third-level indicators: number of international technology input relationships and number of international technological empowerment relationships. Looking at the sub-indicator rankings, Beijing-Tianjin-Hebei maintains a relative lead in previous international study experience, previous international work experience, and international technology input relationships, ranking 1st in these indicators for many years. The Pearl River Delta has dominated the international technological empowerment relationships rankings over the years. The Sichuan-Chongqing region still has room for improvement in terms of international openness.

## 5. Linkage Capabilities Evaluation Indicator Rankings

Table 15 AI S&T Industry Linkage Capabilities Evaluation Indicator Rankings for the Four Major Economic Circles

| Province/Municipality | Linkage Capabilities Evaluation Indicator Rankings (score in parentheses) | | | | |
|---|---|---|---|---|---|
| | 2022 | 2021 | 2020 | 2019 | 2018 |
| Yangtze Delta | 1 (6.3) | 2 (5.4) | 2 | 1 | 2 |
| Pearl River Delta | 2 (4.6) | 3 (3.6) | 3 | 3 | 3 |
| Beijing-Tianjin-Hebei | 3 (3.4) | 1 (6.0) | 1 | 2 | 1 |
| Sichuan-Chongqing | 4 (1.5) | 4 (1.6) | 4 | 4 | 4 |

In terms of linkage capabilities indicator rankings, the Yangtze River Delta region ranked 1st with a score of 6.3, the Pearl River region ranked 2nd with a score of 4.6, the Beijing-Tianjin-Hebei region ranked 3rd with a score of 3.4, and the Sichuan-Chongqing region ranked 4th with a score of 1.5. Compared with other first-level indicators, the rankings of the four major economic circles in terms of the linkage capabilities evaluation indicator have fluctuated greatly over the years. The Yangtze River Delta, Pearl River Delta, and Beijing-Tianjin-Hebei regions have all ranked 1st in linkage capabilities. Among these regions, the Beijing-Tianjin-Hebei region ranked 1st for two consecutive years in 2021 and 2020, but the Yangtze River Delta region captured 1st place in 2022.

The linkage capabilities indicator has 1 second-level indicator, connectors. The connectors indicator includes 2 third-level indicators: number of conferences and number of industry alliances. Looking at the sub-indicator rankings, the Yangtze River Delta maintains a relative lead in the number of conferences and number of industry alliances, earning 1st place in the rankings in recent years. Beijing-Tianjin-Hebei follows closely behind the Yangtze River Delta, ranking 1st in the number of conferences in 2020 and in the number of industry alliances in 2021. The Pearl River Delta and Sichuan-Chongqing regions still need to learn from the other economic circles in terms of linkage capabilities.

## 6. Government Response Capabilities Evaluation Indicator Rankings

Table 16 AI S&T Industry Government Response Capabilities Evaluation Indicator Rankings for the Four Major Economic Circles

| Province/Municipality | Government Response Capabilities Evaluation Indicator Rankings (score in parentheses) | | | | |
|---|---|---|---|---|---|
| | 2022 | 2021 | 2020 | 2019 | 2018 |
| Yangtze Delta | 1 (5.1) | 1 (6.3) | 1 | 1 | 1 |
| Pearl River Delta | 2 (3.2) | 2 (3.2) | 2 | 2 | 3 |
| Beijing-Tianjin-Hebei | 3 (1.6) | 3 (2.4) | 3 | 3 | 2 |
| Sichuan-Chongqing | 4 (1.0) | 4 (1.4) | 4 | 4 | 4 |

In terms of government response capabilities indicator rankings, the Yangtze River Delta region ranked 1st with a score of 5.1, the Pearl River Delta region ranked 2nd with a score of 3.2, the Beijing-Tianjin-Hebei region ranked 3rd with a score of 1.6, and the Sichuan-Chongqing region ranked 4th with a score of 1.0. Compared with other regions, the Sichuan-Chongqing region is at a disadvantage in terms of government response capabilities. The competitive pattern of the four major regions in terms of government response capabilities has remained relatively stable, and the situation has remained basically unchanged over the years.

The government response capabilities indicator has 1 second-level indicator, government response. The government response indicator includes 2 third-level indicators: number of industrial parks and number of policies issued. Looking at the sub-indicator rankings, the Yangtze River Delta maintains a relative lead in number of industrial parks and number of policies issued, earning 1st place in the rankings in recent years. The Pearl River Delta ranks behind the Yangtze River Delta in number of industrial parks, firmly occupying 2nd in the rankings for multiple years running. However, it still has room for improvement in terms of number of policies issued. The Beijing-Tianjin-Hebei region has ranked third in number of industrial parks for many years. In number of policies issued, it is relatively dominant in the rankings due to the advantages conferred by its status as the political center. The Sichuan-Chongqing region requires further improvement in terms of government response capabilities.

## 04 Evaluation Index for City Competitiveness in the Chinese AI S&T Industry

### Comprehensive Ranking

Table 17 Evaluation Indicator Rankings for City Competitiveness in the Chinese AI S&T Industry

| Comprehensive Ranking (score in parentheses) | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2022 | | 2021 | | 2020 | | 2019 | |
| Rank | City | Rank | City | Rank | City | Rank | City |
| 1 | Beijing (81.0) | 1 | Beijing (78.9) | 1 | Beijing | 1 | Beijing |
| 2 | Shenzhen (41.0) | 2 | Shanghai (35.6) | 2 | Shanghai | 2 | Shenzhen |
| 3 | Shanghai (32.1) | 3 | Shenzhen (35.4) | 3 | Shenzhen | 3 | Shanghai |
| 4 | Hangzhou (22.0) | 4 | Hangzhou (21.2) | 4 | Hangzhou | 4 | Hangzhou |
| 5 | Guangzhou (19.7) | 5 | Guangzhou (18.5) | 5 | Qingdao | 5 | Nanjing |
| 6 | Foshan (15.4) | 6 | Dongguan (15.5) | 6 | Dongguan | 6 | Guangzhou |
| 7 | Chengdu (14.5) | 7 | Nanjing (13.3) | 7 | Guangzhou | 7 | Chengdu |
| 8 | Zhuhai (14.3) | 8 | Zhuhai (12.9) | 8 | Nanjing | 8 | Wuhan |
| 9 | Nanjing (14.0) | 9 | Chengdu (12.4) | 9 | Zhengzhou | 9 | Tianjin |
| 10 | Wuhan (9.8) | 10 | Ningde (9.9) | 10 | Chengdu | 10 | Shenyang |
| 11 | Jinan (9.5) | 11 | Tianjin (8.5) | 11 | Tianjin | 11 | Hefei |
| 12 | Tianjin (9.4) | 12 | Wuhan (8.4) | 12 | Hefei | 12 | Xi'an |
| 13 | Hefei (9.0) | 13 | Qingdao (8.2) | 13 | Xi'an | 13 | Changchun |
| 14 | Chongqing (8.8) | 14 | Changsha (8.2) | 14 | Chongqing | 14 | Chongqing |
| 15 | Xi'an (8.7) | 15 | Xi'an (7.8) | 15 | Shenyang | 15 | Jinan |
| 16 | Changsha (8.6) | 16 | Suzhou (7.7) | 16 | Wuhan | 16 | Changsha |
| 17 | Qingdao (8.2) | 17 | Chongqing (7.6) | 17 | Ningde | 17 | Suzhou |
| 18 | Suzhou (8.0) | 18 | Shenyang | 18 | Changchun | 18 | Harbin |
| 19 | Harbin (7.0) | 19 | Hefei (7.2) | 19 | Jinan | 19 | Changzhou |
| 20 | Wuxi (6.9) | 20 | Jinan (7.2) | 20 | Harbin | 20 | Qingdao |

Looking at the city competitiveness evaluation index for China's AI S&T industry in 2022, Beijing, Shenzhen, Shanghai, Hangzhou, and Guangzhou have the highest comprehensive scores, at 81.0, 41.0, 32.1, 22.0, and 19.7 respectively. They constitute the first rank in the development of China's AI S&T industry. Foshan, Chengdu, Zhuhai, and Nanjing have comprehensive scores of 15.4, 14.5, 14.3, and 14.0 respectively. Ranking 6th to 9th after the top five cities, they also possess strong industrial

competitiveness. Wuhan, Jinan, and Tianjin follow closely behind, ranking 10th to 12th with comprehensive scores of 9.8, 9.5, and 9.4.

Comparing the comprehensive rankings of city competitiveness in 2021 and 2022, we see that among the top five cities, Beijing ranked 1st in both years. Shenzhen surpassed Shanghai in 2022, rising from 3rd to 2nd. Shanghai dropped one spot to 3rd. The rankings of Hangzhou and Guangzhou remained stable at 4th and 5th respectively. As far as other cities are concerned, compared with 2021, Foshan, Chengdu, Wuhan, Jinan, Hefei, Chongqing, Harbin, and Wuxi all rose in the rankings. Among these cities, Jinan and Hefei rose significantly by 9 and 6 places respectively, while Foshan, Harbin, and Wuxi are the newest cities in the top 20. In addition, the rankings of Zhuhai and Xi'an did not change compared to 2021, but the rankings of Nanjing, Tianjin, Changsha, Qingdao, and Suzhou have dropped by 2, 1, 2, 4, and 2 places respectively. Dongguan, Ningde, and Shenyang, which were in the top 20 in 2021, dropped out of the top 20 in 2022.

A four-year comparative analysis of the rankings from 2019 to 2022 shows that Beijing, Shenzhen, Shanghai, Hangzhou, Guangzhou, Chengdu, and Nanjing have constantly been among the top ten most competitive cities in the Chinese AI S&T industry. Among these cities, Beijing has always ranked 1st in city competitiveness for the past four years. Looking at its first-level indicators, it has always ranked 1st nationwide in terms of corporate capabilities, academic ecosystem, capital environment, and international openness. Shenzhen ranked 2nd overall in 2019, dropped to 3rd in 2020 and 2021, and rose back to 2nd in 2022. Looking at first-level indicators, Shenzhen has outstanding performance in terms of government response capabilities, linkage capabilities, enterprise capabilities, and international openness. Shanghai's comprehensive ranking was 3rd in 2019, rose to 2nd in 2020 and 2021, and dropped 1 place to 3rd in 2022. Looking at first-level indicators, Shanghai's ranking in academic ecosystem, capital environment, and international openness have remained stable in the last two years at 3rd, 2nd, and 3rd respectively. In enterprise capabilities, linkage capabilities, and government response capabilities, it ranked 4th, 4th, and 2nd respectively, falling 1 place, 2 places, and 1 place respectively compared to 2021. Hangzhou's comprehensive ranking has remained stable over the last four years at 4th nationwide. It has prominent advantages in first-level evaluation indicators such as capital environment, international openness, and government response capabilities. Guangzhou's comprehensive city competitiveness ranking was 6th nationwide in 2019 and dropped one place to 7th in 2020. In 2021 its ranking rose to 5th, where it stayed for 2022. Looking at first-level indicators, Guangzhou's advantages are in capital environment and international openness. Over the past four years, Chengdu's AI S&T industry city competitiveness indicator ranked 7th, 10th, 9th,

and 7th nationwide. It is worth noting that Chengdu stands out for its strength in academic ecosystem, which gives the city its AI advantages. Nanjing's AI S&T industry city competitiveness indicator ranked 5th, 8th, 7th, and 9th over the last four years. It has comparative advantages in academic ecosystem, capital environment, and international openness.

## Evaluation Sub-Indicator Rankings

### 1. Enterprise Capabilities Evaluation Indicator Rankings

Table 18 Enterprise Capabilities Evaluation Indicator Rankings for City Competitiveness in the Chinese AI S&T Industry

| Enterprise Capabilities Evaluation Indicator Rankings (score in parentheses) | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2022 | | 2021 | | 2020 | | 2019 | |
| Rank | City | Rank | City | Rank | City | Rank | City |
| 1 | Beijing (31.6) | 1 | Beijing (28.9) | 1 | Beijing | 1 | Beijing |
| 2 | Shenzhen (19.5) | 2 | Shenzhen (18.0) | 2 | Shanghai | 2 | Shenzhen |
| 3 | Foshan (14.4) | 3 | Shanghai (13.6) | 3 | Shenzhen | 3 | Shanghai |
| 4 | Shanghai (13.2) | 4 | Dongguan (13.1) | 4 | Hangzhou | 4 | Hangzhou |
| 5 | Zhuhai (11.8) | 5 | Zhuhai (11.9) | 5 | Qingdao | 5 | Changzhou |
| 6 | Hangzhou (9.8) | 6 | Ningde (9.5) | 6 | Dongguan | 6 | Wuhan |
| 7 | Guangzhou (9.7) | 7 | Hangzhou (8.5) | 7 | Guangzhou | 7 | Tianjin |
| 9 | Jinan (4.5) | 8 | Guangzhou (8.0) | 8 | Nanjing | 8 | Jinan |
| 10 | Nanjing (3.2) | 11 | Qingdao (4.1) | 9 | Zhengzhou | 9 | Guangzhou |
| 11 | Suzhou (3.0) | 13 | Suzhou (2.7) | 11 | Chengdu | 10 | Nanjing |
| 12 | Qingdao (2.9) | 14 | Nanjing (2.6) | 12 | Tianjin | 11 | Chengdu |
| 14 | Hefei (2.7) | 15 | Changsha (2.5) | 13 | Hefei | 12 | Qingdao |
| 15 | Chengdu (2.7) | 17 | Chengdu (2.4) | 14 | Xi'an | 13 | Suzhou |
| 16 | Changsha (2.6) | 18 | Jinan (2.3) | 15 | Chongqing | 14 | Hefei |
| 17 | Wuhan (2.1) | 19 | Tianjin (2.2) | 17 | Shenyang | 15 | Changsha |
| 18 | Chongqing (2.0) | 22 | Hefei (1.9) | 18 | Wuhan | 16 | Xi'an |
| 22 | Tianjin (1.5) | 23 | Wuhan (1.8) | 22 | Ningde | 18 | Chongqing |
| 25 | Wuxi (1.2) | 28 | Shenyang (1.4) | 27 | Changchun | 23 | Shenyang |
| 26 | Xi'an (1.1) | 29 | Chongqing (1.3) | 32 | Jinan | 37 | Harbin |
| 28 | Harbin (0.7) | 45 | Xi'an (0.6) | 52 | Harbin | 49 | Changchun |

Looking at the enterprise capabilities evaluation indicator for the Chinese AI S&T industry city competitiveness in 2022, the top five cities in terms of enterprise capabilities were Beijing, Shenzhen, Foshan, Shanghai, and Zhuhai, with scores of 31.6, 19.5, 14.4, 13.2, and 11.8 respectively. In terms of second-level indicators, the top five cities by enterprise scale indicator score were Beijing, Shenzhen, Shanghai, Hangzhou, and Guangzhou, with scores of 19.3, 11.1, 8.4, 6.0, and 5.7 respectively; the top five cities by enterprise innovation capabilities indicator score were Foshan, Beijing, Zhuhai, Shenzhen, and Shanghai, with scores of 13.1, 12.3, 10.3, 8.5, and 4.8 respectively.

From 2019 to 2022, Beijing, Shenzhen, Shanghai, Hangzhou, and Guangzhou have ranked among the top ten cities in terms of enterprise capability score for four consecutive years. Specifically looking at the 5 three-level indicators, Beijing ranked first in number of enterprises, number of basic and technology level enterprises, and number of technological empowerment relationships. Shenzhen ranked 1st in average enterprise valuation. Shanghai has comparative advantages in 3 third-level indicators: number of enterprises, number of basic and technology level enterprises, and number of technological empowerment relationships. Hangzhou's strength is more prominent in the 4 three-level indicators of number of enterprises, average enterprise valuation, number of basic and technology level enterprises, and number of technological empowerment relationships. Guangzhou has a relative superiority in the 3 third-level indicators of number of enterprises, number of basic and technology level enterprises, and number of technological empowerment relationships.

## 2. Academic Ecosystem Evaluation Indicator Rankings

Table 19 Academic Ecosystem Evaluation Indicator Rankings for City Competitiveness in the Chinese AI S&T Industry

| Academic Ecosystem Evaluation Indicator Rankings (score in parentheses) | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2022 | | 2021 | | 2020 | | 2019 | |
| Rank | City | Rank | City | Rank | City | Rank | City |
| 1 | Beijing (17.7) | 1 | Beijing (16.9) | 1 | Beijing | 1 | Beijing |
| 2 | Chengdu (9.7) | 2 | Chengdu (7.9) | 2 | Shanghai | 2 | Shanghai |
| 3 | Shanghai (7.7) | 3 | Shanghai (7.0) | 3 | Changchun | 3 | Changchun |
| 4 | Nanjing (6.9) | 4 | Xi'an (6.1) | 4 | Xi'an | 4 | Shenyang |
| 5 | Xi'an (6.1) | 5 | Nanjing (6.0) | 5 | Nanjing | 5 | Xi'an |
| 6 | Hangzhou (5.9) | 7 | Hangzhou (5.2) | 6 | Hangzhou | 6 | Chengdu |
| 7 | Chongqing (5.6) | 8 | Shenyang (5.0) | 7 | Guangzhou | 7 | Hangzhou |
| 8 | Guangzhou (5.5) | 9 | Wuhan (4.7) | 8 | Chengdu | 8 | Nanjing |
| 9 | Wuhan (5.4) | 11 | Guangzhou (4.6) | 9 | Harbin | 9 | Chongqing |
| 10 | Harbin (5.3) | 13 | Tianjin (4.1) | 10 | Shenyang | 10 | Guangzhou |
| 12 | Tianjin (5.0) | 14 | Hefei (3.5) | 11 | Wuhan | 11 | Shenzhen |
| 13 | Hefei (4.6) | 16 | Chongqing (3.4) | 13 | Hefei | 12 | Harbin |
| 14 | Shenzhen (4.6) | 17 | Changsha (3.4) | 14 | Tianjin | 13 | Wuhan |
| 15 | Wuxi (4.2) | 18 | Jinan (3.4) | 16 | Chongqing | 14 | Changsha |
| 16 | Changsha (3.8) | 19 | Shenzhen (3.3) | 18 | Jinan | 15 | Hefei |
| 17 | Jinan (3.4) | 20 | Qingdao (2.9) | 20 | Shenzhen | 16 | Tianjin |
| 20 | Qingdao (3.2) | 22 | Suzhou (2.6) | 21 | Qingdao | 17 | Jinan |
| 29 | Suzhou (0.8) | 89 | Dongguan (0.1) | 28 | Zhengzhou | 18 | Suzhou |
| 31 | Foshan (0.0) | 91 | Zhuhai (0.0) | 41 | Dongguan | 23 | Qingdao |
| 31 | Zhuhai (0.0) | 91 | Ningde (0.0) | 44 | Ningde | 28 | Changzhou |

In terms of the academic ecosystem evaluation indicator for the Chinese AI S&T industry city competitiveness in 2022, the top five cities in terms of academic ecosystem were Beijing, Chengdu, Shanghai, Nanjing, and Xi'an, with scores of 17.7, 9.7, 7.7, 6.9, and 6.1 respectively. In terms of the second-level indicators for academic ecosystem, the top five cities by AI university innovation capabilities indicator score were Beijing, Nanjing, Shanghai, Chengdu, and Xi'an, with scores of 9.0, 6.8, 6.6, 6.0, and 5.8, respectively. The top five cities by non-university scientific research institute innovation capabilities indicator score were Beijing, Chengdu, Shenzhen, Chongqing, and Changchun, with scores of 8.8, 3.7, 2.2, 2.0, and 1.8 respectively.

From 2019 to 2022, Beijing, Chengdu, Shanghai, Nanjing, Xi'an, and Hangzhou ranked among the top ten cities in terms of academic ecosystem score for four consecutive years. Specifically looking at the 8 third-level indicators, Beijing ranked first in number of AI universities, number of non-university scientific research institutes, and average number of international research papers by non-university scientific research institutes. Chengdu ranked first in average number of domestic research papers and average number of patents by non-university scientific research institutes Shanghai has relative advantages in the 2 third-level indicators of number of AI universities and number of non-university scientific research institutes. Nanjing showed outstanding performance for the 2 third-level indicators of number of AI universities and average number of international research papers by non-university scientific research institutes. Xi'an had relative competitiveness advantages in the 2 third-level indicators of average number of international research papers by non-university scientific research institutes and number of non-university scientific research institutes. Hangzhou had relative superiority in the rankings for the 3 third-level indicators of average number of patents by AI universities, number of non-university scientific research institutes, and average number of international research papers by non-university scientific research institutes.

### 3. Capital Environment Evaluation Indicator Rankings

In terms of the capital environment evaluation indicator for Chinese AI S&T industry city competitiveness in 2022, the top five cities in terms of capital environment were Beijing, Shanghai, Shenzhen, Hangzhou, and Guangzhou, with scores of 18.7, 5.0, 4.8, 2.2, and 1.8 respectively.

In terms of second-level indicators for capital environment in 2022, the top five cities by investment indicator score were Beijing, Shenzhen, Shanghai, Guangzhou, and Hangzhou, with scores of 4.8, 2.2, 1.6, 1.1, and 1.0 respectively; the top five cities by financing indicator score were Beijing, Shanghai, Shenzhen, Hangzhou, and Tianjin, with scores of 13.8, 3.4, 2.6, 1.2, and 1.1 respectively.

From 2019 to 2022, Beijing, Shanghai, Shenzhen, Hangzhou, Guangzhou, and Nanjing ranked among the top ten cities in terms of capital environment score for four consecutive years. Specifically looking at the 3 third-level indicators, Beijing ranked 1st in number of investment relationships, number of financing relationships, and amount of financing. Shanghai ranked 2nd in number of investment relationships and amount of financing. Shenzhen had relative advantages in number of investment relationships. Guangzhou exhibited attention-grabbing performance in number of investment relationships. Nanjing's strength is more apparent in amount of financing.

Table 20 Capital Environment Evaluation Indicator Rankings for City Competitiveness in the Chinese AI S&T Industry

| Capital Environment Evaluation Indicator Rankings (score in parentheses) | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2022 | | 2021 | | 2020 | | 2019 | |
| Rank | City | Rank | City | Rank | City | Rank | City |
| 1 | Beijing (18.7) | 1 | Beijing (18.7) | 1 | Beijing | 1 | Beijing |
| 2 | Shanghai (5.0) | 2 | Shanghai (6.3) | 2 | Shanghai | 2 | Hangzhou |
| 3 | Shenzhen (4.8) | 3 | Shenzhen (4.4) | 3 | Hangzhou | 3 | Shanghai |
| 4 | Hangzhou (2.2) | 4 | Hangzhou (2.4) | 4 | Shenzhen | 5 | Nanjing |
| 5 | Guangzhou (1.8) | 5 | Guangzhou (1.8) | 5 | Nanjing | 7 | Shenzhen |
| 6 | Nanjing (1.7) | 6 | Nanjing (1.8) | 6 | Guangzhou | 8 | Guangzhou |
| 7 | Tianjin (1.3) | 7 | Suzhou (0.6) | 7 | Tianjin | 10 | Suzhou |
| 8 | Zhuhai (0.8) | 8 | Wuhan (0.4) | 10 | Wuhan | 13 | Shenyang |
| 9 | Suzhou (0.7) | 9 | Zhuhai (0.4) | 11 | Shenyang | 14 | Hefei |
| 10 | Qingdao (0.4) | 10 | Chengdu (0.3) | 12 | Hefei | 15 | Chengdu |
| 11 | Chengdu (0.4) | 11 | Ningde (0.3) | 13 | Ningde | 16 | Wuhan |
| 12 | Wuhan (0.4) | 13 | Changsha (0.3) | 15 | Qingdao | 17 | Jinan |
| 15 | Changsha (0.3) | 14 | Qingdao (0.3) | 16 | Chengdu | 20 | Chongqing |
| 17 | Wuxi (0.3) | 15 | Dongguan (0.3) | 20 | Jinan | 22 | Changsha |
| 18 | Hefei (0.2) | 16 | Tianjin (0.3) | 22 | Chongqing | 23 | Tianjin |
| 20 | Jinan (0.2) | 17 | Hefei (0.3) | 24 | Xi'an | 24 | Qingdao |
| 21 | Chongqing (0.2) | 18 | Jinan (0.2) | 28 | Dongguan | 25 | Changchun |
| 23 | Foshan (0.1) | 19 | Shenyang (0.2) | 30 | Harbin | 29 | Changzhou |
| 25 | Harbin (0.1) | 21 | Chongqing (0.2) | 46 | Zhengzhou | 34 | Xi'an |
| 27 | Xi'an (0.1) | 27 | Xi'an (0.1) | 47 | Changchun | 47 | Harbin |

## 4. International Openness Evaluation Indicator Rankings

Table 21 International Openness Evaluation Indicator Rankings for City Competitiveness in the Chinese AI S&T Industry

| International Openness Evaluation Indicator Rankings (score in parentheses) | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2022 | | 2021 | | 2020 | | 2019 | |
| Rank | City | Rank | City | Rank | City | Rank | City |
| 1 | Beijing (7.8) | 1 | Beijing (7.8) | 1 | Beijing | 1 | Beijing |
| 2 | Shenzhen (4.6) | 2 | Shenzhen (5.1) | 2 | Shenzhen | 2 | Hangzhou |
| 3 | Shanghai (3.1) | 3 | Shanghai (3.2) | 3 | Hangzhou | 3 | Shenzhen |
| 4 | Hangzhou (1.9) | 4 | Hangzhou (1.9) | 4 | Shanghai | 4 | Shanghai |
| 5 | Guangzhou (0.8) | 5 | Guangzhou (0.9) | 5 | Shenyang | 5 | Hefei |
| 6 | Nanjing (0.4) | 6 | Nanjing (0.4) | 6 | Nanjing | 7 | Nanjing |
| 7 | Suzhou (0.3) | 7 | Suzhou (0.3) | 7 | Guangzhou | 8 | Tianjin |
| 8 | Zhuhai (0.3) | 8 | Zhuhai (0.3) | 9 | Tianjin | 9 | Qingdao |
| 9 | Tianjin (0.2) | 9 | Dongguan (0.2) | 10 | Chongqing | 10 | Suzhou |
| 11 | Chengdu (0.2) | 10 | Shenyang (0.2) | 11 | Dongguan | 12 | Guangzhou |
| 13 | Hefei (0.2) | 11 | Hefei (0.2) | 12 | Hefei | 13 | Shenyang |
| 15 | Wuhan (0.2) | 13 | Chengdu (0.2) | 17 | Xi'an | 14 | Chongqing |
| 16 | Chongqing (0.1) | 14 | Tianjin (0.2) | 20 | Jinan | 15 | Changsha |
| 18 | Changsha (0.1) | 15 | Wuhan (0.2) | 23 | Qingdao | 17 | Wuhan |
| 19 | Wuxi (0.1) | 16 | Chongqing (0.1) | 28 | Chengdu | 18 | Chengdu |
| 20 | Jinan (0.1) | 18 | Changsha (0.1) | 32 | Wuhan | 22 | Jinan |
| 21 | Qingdao (0.1) | 20 | Jinan (0.1) | 32 | Ningde | 30 | Changchun |
| 23 | Foshan (0.1) | 22 | Qingdao (0.1) | 32 | Harbin | 30 | Changzhou |
| 28 | Xi'an (0.0) | 40 | Xi'an (0.0) | 32 | Zhengzhou | 30 | Xi'an |
| 31 | Harbin (0.0) | 41 | Ningde (0.0) | 32 | Changchun | 30 | Harbin |

Looking at the international openness evaluation indicator rankings for 2022, Beijing, Shenzhen, Shanghai, Hangzhou, and Guangzhou ranked in the top five, with scores of 7.8, 4.6, 3.1, 1.9, and 0.8 respectively. We can see that Beijing possesses absolute strength in terms of international openness.

In terms of the second-level indicators for international openness in 2022, the top five cities by core human capital openness indicator score were Beijing, Shenzhen, Shanghai, Hangzhou, and Guangzhou, with scores of 2.9, 1.3, 1.0, 0.5, and 0.3 respectively; the top five cities by technology openness indicator score were Beijing, Shenzhen, Shanghai, Hangzhou, and Guangzhou, with scores of 4.8, 3.3, 2.1, 1.4, and 0.5 respectively.

Looking at the continuous data from the four-year period of 2019 to 2022, Beijing, Shenzhen, Shanghai, Hangzhou, and Nanjing consistently ranked in the top ten by evaluation indicator score. These cities showed strong consistency in their rankings across first-level, second-level, and third-level international openness indicators. Among the cities, Beijing ranked first in the evaluation indicators at all levels, Shenzhen ranked second in the evaluation indicators at all levels, and Shanghai ranked third in the evaluation indicators at all levels.

### 5. Linkage Capabilities Evaluation Indicator Rankings

Table 22 Linkage Capabilities Evaluation Indicator Rankings for City Competitiveness in the Chinese AI S&T Industry

| Linkage Capabilities Evaluation Indicator Rankings (score in parentheses) | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2022 | | 2021 | | 2020 | | 2019 | |
| Ranking | City | Ranking | City | Ranking | City | Ranking | City |
| 1 | Shenzhen (4.4) | 1 | Beijing (5.1) | 1 | Beijing | 1 | Beijing |
| 2 | Beijing (4.1) | 2 | Shanghai (2.3) | 2 | Shanghai | 2 | Shanghai |
| 3 | Suzhou (1.8) | 3 | Shenzhen (1.8) | 3 | Shenzhen | 3 | Hangzhou |
| 4 | Shanghai (1.7) | 4 | Guangzhou (1.0) | 4 | Chongqing | 4 | Shenzhen |
| 5 | Qingdao (1.4) | 5 | Hangzhou (1.0) | 5 | Hangzhou | 5 | Guangzhou |
| 6 | Wuhan (1.4) | 6 | Chongqing (0.9) | 6 | Tianjin | 6 | Tianjin |
| 7 | Guangzhou (1.3) | 7 | Chengdu (0.6) | 7 | Hefei | 7 | Changsha |
| 8 | Chengdu (1.2) | 8 | Tianjin (0.5) | 8 | Jinan | 8 | Chongqing |
| 9 | Zhuhai (1.2) | 9 | Changsha (0.5) | 9 | Chengdu | 9 | Nanjing |
| 10 | Changsha (1.2) | 10 | Nanjing (0.5) | 10 | Guangzhou | 10 | Suzhou |
| 11 | Jinan (1.0) | 11 | Hefei (0.5) | 11 | Nanjing | 11 | Hefei |
| 12 | Hangzhou (0.9) | 12 | Jinan (0.5) | 15 | Wuhan | 12 | Jinan |
| 13 | Xi'an (0.8) | 13 | Suzhou (0.4) | 16 | Harbin | 12 | Harbin |
| 15 | Harbin (0.7) | 18 | Wuhan (0.2) | 17 | Xi'an | 14 | Chengdu |
| 16 | Wuxi (0.7) | 19 | Xi'an (0.2) | 19 | Qingdao | 15 | Wuhan |
| 17 | Tianjin (0.7) | 21 | Dongguan (0.2) | 20 | Zhengzhou | 21 | Xi'an |
| 18 | Nanjing (0.6) | 23 | Qingdao (0.1) | 22 | Dongguan | 23 | Shenyang |
| 20 | Foshan (0.5) | 27 | Shenyang (0.1) | 31 | Shenyang | 23 | Changchun |
| 21 | Hefei (0.5) | 41 | Zhuhai (0.1) | 31 | Changchun | 27 | Qingdao |
| 29 | Chongqing (0.1) | 87 | Ningde (0.0) | 87 | Ningde | 27 | Changzhou |

Looking at the linkage capabilities evaluation indicator rankings, Shenzhen, Beijing, Suzhou, Shanghai, and Qingdao ranked in the top five in 2022, with scores of 4.4, 4.1, 1.8, 1.7, and 1.4 respectively. The evaluation indicator scores of Shenzhen and Beijing were both over 4, placing them in the first rank, with obvious leading advantages over the other cities.

Looking at the continuous data from the four-year period of 2019 to 2022, Shenzhen, Beijing, Shanghai, and Guangzhou consistently ranked in the top ten by evaluation indicator score. Among these cities, Shenzhen showed an absolute superiority in number of industry alliances. Beijing demonstrated absolute strength in terms of the number of conferences, while Shanghai demonstrated attention-grabbing performance in terms of the number of conferences and is in an advantageous position in terms of conducting AI-related conferences and exchanges. Guangzhou had balanced performance in number of industrial alliances and number of conferences. In 2022, it ranked 7th in both indicators, which is consistent with its overall regional linkage capabilities evaluation indicator ranking.

## 6. Government Response Capabilities Evaluation Indicator Rankings

Table 23 Government Response Capabilities Evaluation Indicator Rankings for City Competitiveness in the Chinese AI S&T Industry

| Government Response Capabilities Evaluation Indicator Rankings (score in parentheses) | | | | | | | |
|---|---|---|---|---|---|---|---|
| 2022 | | 2021 | | 2020 | | 2019 | |
| Ranking | City | Ranking | City | Ranking | City | Ranking | City |
| 1 | Shenzhen (3.0) | 1 | Shanghai (3.2) | 1 | Shanghai | 1 | Shenzhen |
| 2 | Shanghai (1.5) | 2 | Shenzhen (2.9) | 2 | Shenzhen | 2 | Guangzhou |
| 3 | Suzhou (1.5) | 3 | Hangzhou (2.2) | 3 | Chongqing | 3 | Shanghai |
| 4 | Hangzhou (1.3) | 4 | Guangzhou (2.1) | 4 | Guangzhou | 4 | Hangzhou |
| 6 | Beijing (1.1) | 5 | Nanjing (1.9) | 5 | Hangzhou | 4 | Hefei |
| 7 | Nanjing (1.1) | 6 | Chongqing (1.7) | 6 | Nanjing | 6 | Beijing |
| 8 | Tianjin (0.8) | 7 | Beijing (1.7) | 7 | Qingdao | 7 | Nanjing |
| 9 | Chongqing (0.8) | 8 | Dongguan (1.6) | 8 | Beijing | 8 | Tianjin |
| 10 | Hefei (0.7) | 9 | Changsha (1.3) | 9 | Hefei | 9 | Shenyang |
| 11 | Guangzhou (0.6) | 10 | Tianjin (1.1) | 10 | Tianjin | 10 | Wuhan |
| 12 | Xi'an (0.6) | 11 | Suzhou (1.1) | 11 | Wuhan | 11 | Chengdu |
| 13 | Changsha (0.5) | 12 | Wuhan (1.0) | 12 | Chengdu | 14 | Chongqing |
| 14 | Wuxi (0.5) | 13 | Chengdu (1.0) | 14 | Jinan | 17 | Suzhou |
| 15 | Wuhan (0.4) | 15 | Hefei (0.9) | 15 | Xi'an | 21 | Changsha |
| 16 | Chengdu (0.3) | 16 | Xi'an (0.8) | 18 | Shenyang | 22 | Changchun |
| 17 | Zhuhai (0.3) | 19 | Jinan (0.8) | 22 | Zhengzhou | 26 | Qingdao |
| 18 | Jinan (0.3) | 22 | Qingdao (0.6) | 23 | Changchun | 30 | Xi'an |
| 19 | Foshan (0.2) | 25 | Shenyang (0.5) | 30 | Dongguan | 34 | Changzhou |
| 21 | Qingdao (0.2) | 48 | Zhuhai (0.2) | 59 | Harbin | 35 | Jinan |
| 25 | Harbin (0.1) | 168 | Ningde (0.0) | 108 | Ningde | 41 | Harbin |

Looking at the government response capabilities evaluation indicator for 2022, Shenzhen, Shanghai, Suzhou, Hangzhou, and Beijing ranked in the top five nationwide, with scores of 3.0, 1.5, 1.5, 1.3, and 1.1 respectively. The evaluation indicator score of Shenzhen places it far ahead of the other cities.

Looking at the continuous data from the four-year period of 2019 to 2022, Shenzhen, Shanghai, Hangzhou, Beijing, Nanjing, and Tianjin consistently ranked in the top ten by government response capabilities evaluation indicator score. Government response capabilities consists of two third-level indicators: number of industrial parks

and number of policies issued. Among these indicators, Shenzhen had absolute superiority in the planning and construction of AI industrial parks. In addition, Shanghai and Nanjing also demonstrated outstanding performance. Tianjin and Hangzhou are ranked higher in terms of policy issuance because their governments have issued a large number of policies to support the development of their local AI industries.