

Research on the Countermeasures of Urban Innovation Ecosystem

-- Take Hangzhou as an Example

Jinhua Liu

School of Economics & Management, China Jiliang University, Hangzhou 310018, China

Abstract

The development of urban innovation ecosystem has new requirements in the era of digital economy. By constructing a niche suitability model of regional innovation ecosystem, Hangzhou, Beijing, Shanghai, Guangzhou and Shenzhen are regarded as ecosystems in the same whole, and the niche suitability model is constructed to compare the four cities in different innovation ecological factors, so as to provide a scientific basis for Hangzhou to further improve its regional innovation ability.

Keywords

Digital Economy; Urban Innovation; Ecosystem; Countermeasure Research.

1. Introduction

At present, it is at the historical intersection of the transformation and upgrading of economic structure, the outbreak of a new round of scientific and technological revolution. The breadth and depth of the real economy using network information technology continue to expand and emerge. The digital economy is becoming an important tool to drive the development of GDP. Urban development pays more attention to the development of high-tech and emerging industries, and it is of great practical significance to explore the countermeasures of urban innovation ecosystem.

Regional innovation system is the basis for establishing an innovative country, which has a positive and important promoting significance for the country's scientific and technological progress and social and economic development [1]. Under the trend of globalization, the flow of information and economic resources continues to gather in regions [2]. The regional innovation system is an important support of the national innovation system. Improving the innovation efficiency of the regional innovation system, reducing the innovation cost, and integrating various resources, knowledge and information are the key to improve the overall innovation level of the region [3-4]. The three main substantive factors of China's regional innovation system are composed of some high-tech resources facing the socialist market economy, new enterprises with flexible operation mechanism, new socialist economic development policies and management measures of local people's governments[5]. Based on the traditional idea of urban center, urban innovation system is an important part of regional innovation system. Relying on the scientific and technological information resources and innovation infrastructure in the region, we should strengthen the exchanges and cooperation with government, industry, University, research and intermediary institutions, including the main institutions and organizations of innovation, the resources that must be used for innovation, and the laws and regulations that coordinate the links between various elements Policies and so on cross operate in the process of innovation to form an open system. It will be called an open and more effective construction resource allocation model, improve a city's independent innovation ability and comprehensive competitiveness, and promote the sustainable development of regional economy[6].

The research status at home and abroad has a certain reference significance for the construction of urban innovation ecosystem in the era of digital economy. Based on the above research, this paper evaluates the niche suitability of Hangzhou regional innovation ecosystem, and finds out the weak links of Hangzhou innovation ecosystem and the bottlenecks restricting the development of its innovation system. Therefore, this paper summarizes the Countermeasures of Hangzhou's urban innovation ecosystem in the era of digital economy.

2. Basic Situation of Innovation and Development in Hangzhou

With the in-depth promotion of the construction of Hangzhou's "Internet +", innovative digital manufacturing economy and "new manufacturing plan", innovative technology has gradually developed into an important force and driving engine to promote the economic and social development of Hangzhou, and a number of leading enterprises in the field of high-end equipment technology manufacturing with advanced innovative technology have emerged, It has initially developed and basically has its innovation ability and competitive advantage to actively participate in international competition in a large range of the world. At present, Hangzhou has successfully developed and gathered a number of domestic and foreign industry leading innovative technology products and service enterprises in various high-end industries represented by China Alibaba company. These large high-end innovative enterprises have strong comprehensive technical strength and strong innovation ability.

Hangzhou has formed a new-type scientific and technological enterprise innovation and harmonious scientific and technological entrepreneurship social and cultural atmosphere in which enterprises respect knowledge, advocate scientific and technological innovation and protect their independent knowledge creation. It puts forward higher technical requirements for continuously strengthening the use and protection of enterprise intellectual property rights, quickly solving and handling all kinds of new-type intellectual property disputes, and providing richer and diversified intellectual property consulting services. The major urgent technical problems need to be solved to adapt to the current internal technology enterprises in Hangzhou, such as rapid verification and use of intellectual property rights according to law, rapid confirmation according to law, and rapid protection of rights according to law.

3. Materials and Methods

3.1 Data Sources

Taking Beijing, Shanghai, Guangzhou, Shenzhen and Hangzhou as the research objects, this paper obtains the niche suitability of the five cities through the construction of models and data analysis, so as to obtain the advantages and disadvantages of each city's regional innovation ecosystem.

3.2 Selection of Evaluation Indicators

The suitability evaluation system of regional innovation ecosystem is a tool to measure the suitability between the required resource position and the actual resource position of Regional Innovation Ecosystem in innovation activities. The establishment of the evaluation index system needs to follow the following principles: science and reality, system integrity and openness, operability and comparability. Therefore, this paper chose the following indicators as the basis for constructing the evaluation model:

Table 1. Niche suitability evaluation index system of Regional Innovation Ecosystem

Ecological elements	Ecological factors
Y ₁ Innovative institutions	X ₁ Number of high-tech enterprises
	X ₂ Number of colleges and universities
	X ₃ Number of full-time teachers in Colleges and Universities
Y ₂ Innovative resources	X ₄ Total social R & D expenditure
	X ₅ R & D personnel converted into full-time equivalent
	X ₆ Investment in fixed assets of the whole society
	X ₇ Number of technology incubators
Y ₃ Innovation efficiency	X ₈ Added value of high-tech industry
	X ₉ Number of patents authorized
Y ₄ Innovation vitality	X ₁₀ Total FDI
	X ₁₁ Technology market turnover
Y ₅ Innovation potential	X ₁₂ Added value of information industry
	X ₁₃ Total expenditure on Education
	X ₁₄ College students (including graduate students)
	X ₁₅ Telecom business volume
Y ₆ Innovation environment	X ₁₆ Per capita disposable income of rural residents
	X ₁₇ Per capita living consumption expenditure of rural residents
	X ₁₈ Per capita disposable income of urban residents
	X ₁₉ Per capita living consumption expenditure of urban residents
	X ₂₀ Per capita GDP
	X ₂₁ Domestic and foreign currency financial deposits of the whole society
	X ₂₂ Total social consumer goods

3.3 Construction of evaluation model

3.3.1 Standardized Processing of Raw Data

Assuming that the research object includes m regional innovation ecosystems and the ecological factors of the evaluation index system are n , it can be recorded as X_j ($j = 1, 2, \dots, n$). The judgment matrix can be obtained by using the statistical yearbook and national economy and statistical bulletin of each city:

$$R = (r_{ij})_{m \times n} \quad (i = 1, 2, \dots, m, j = 1, 2, \dots, n)$$

Where r_{ij} represents the specific value of the i -th ecosystem on the j -th ecological factor. Due to different index units, in order to eliminate the dimensional influence, the extreme value method is used to standardize the judgment matrix:

$$r'_{ij} = \frac{r_{ij} - \min_i |r_{ij}|}{\max_i |r_{ij}| - \min_i |r_{ij}|} \quad (1)$$

The judgment matrix after dimensionless processing is obtained:

$$R' = (r'_{ij})_{m \times n} \quad (i = 1, 2, \dots, m, j = 1, 2, \dots, n)$$

3.3.2 Determination of Ecological Factor Weight

The information entropy of each ecological factor can be calculated by using the judgment matrix after standardized treatment, ω_j is the weight of the j -th ecological factor can be obtained:

$$e_j = -\frac{1}{\ln m} \sum_{i=1}^m k_{ij} \ln k_{ij} \quad (2)$$

$$k_{ij} = \frac{r'_{ij}}{\sum_{i=1}^m r'_{ij}}$$

$$\omega_j = \frac{1-e_j}{n-\sum_{j=1}^n e_j} \quad (3)$$

$$F_i = \sum_{j=1}^n \omega_j \frac{\delta_{min} + \alpha \delta_{max}}{\delta_{ij} + \alpha \delta_{max}} = \sum_{j=1}^n \omega_j \frac{\min\{x'_{ij} - x'_{aj}\} + a \max\{x'_{ij} - x'_{aj}\}}{|x'_{ij} - x'_{aj}| + a \max\{x'_{ij} - x'_{aj}\}} \quad (4)$$

F_i indicates the niche suitability value; ω_j represents the weight of ecological factors; x'_{ij} represents a standardized statistical value; x'_{aj} represents the optimal value of the j -th ecological factor; $\delta_{ij} = |x'_{ij} - x'_{wj}|$ ($i = 1, 2, \dots, m, j = 1, 2, \dots, n$) represents the absolute difference between x'_{ij} and x'_{aj} . When $F_i = 0.5, \bar{\delta}_{ij} = \frac{\sum_{i=1}^m \sum_{j=1}^n \delta_{ij}}{mn}, a = \frac{\bar{\delta}_{ij} - 2\delta_{min}}{\delta_{max}}$.

4. Research Results and Analysis

4.1 Results

After standardizing the original data, the following data can be obtained:

Table 2. Standardized values of ecological factors in five cities

	Beijing	Shanghai	Guangzhou	Shenzhen	Hangzhou
Number of high-tech enterprises	1.000	0.496	0.000	0.562	0.057
	1.000	0.715	0.905	0.000	0.396
Number of colleges and Universities	0.890	1.000	0.875	0.000	0.407
	1.000	0.685	0.179	0.504	0.000
Number of teachers in Colleges and Universities	1.000	0.615	0.000	0.439	0.281
	1.000	0.751	0.549	0.000	0.481
Total social R & D expenditure	0.715	1.000	0.760	0.660	0.000
	0.830	1.000	0.214	0.923	0.000
R & D personnel converted into full-time equivalent	1.000	0.484	0.000	0.636	0.218
	0.685	1.000	0.000	0.185	0.231
Investment in fixed assets of the whole society	1.000	0.334	0.103	0.228	0.000
	0.862	1.000	0.000	0.335	0.829
Number of technology incubators	1.000	0.891	0.203	0.203	0.000
	0.635	0.543	1.000	0.000	0.475
Added value of high-tech industry	1.000	0.849	0.592	0.688	0.000
	0.295	0.627	0.000	0.831	1.000
Number of patents authorized	0.229	0.100	0.257	0.225	1.000
	0.963	1.000	0.000	0.906	0.354
Actual amount of FDI	0.933	1.000	0.818	0.718	0.000
	0.098	0.075	0.664	1.000	0.267
Technology market turnover	1.000	0.799	0.231	0.283	0.000
	1.000	0.940	0.673	0.157	0.000

The information entropy can be obtained by using formula (2):

Table 3. Information entropy of ecological factors

Information entropy	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	X ₁₀	X ₁₁
	0.740	0.892	0.916	0.816	0.825	0.898	0.894	0.838	0.835	0.678	0.659
	X ₁₂	X ₁₃	X ₁₄	X ₁₅	X ₁₆	X ₁₇	X ₁₈	X ₁₉	X ₂₀	X ₂₁	X ₂₂
	0.850	0.731	0.916	0.938	0.846	0.701	0.852	0.904	0.735	0.821	0.797

The weight is obtained by formula (3):

Table 4. Weight of ecological factors

	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈	X ₉	X ₁₀	X ₁₁
Weight	0.074	0.041	0.042	0.060	0.043	0.040	0.048	0.047	0.057	0.074	0.088
	X ₁₂	X ₁₃	X ₁₄	X ₁₅	X ₁₆	X ₁₇	X ₁₈	X ₁₉	X ₂₀	X ₂₁	X ₂₂
Weight	0.045	0.075	0.043	0.039	0.048	0.080	0.045	0.037	0.075	0.059	0.060

Then the niche suitability of each city is obtained through formula (4):

Table 5. Niche suitability of Regional Innovation Ecosystem in five cities

Cities	Niche suitability	Ranking
Beijing	0.903	1
Shenzhen	0.726	2
Shenzhen	0.575	3
Hangzhou	0.563	4
Guangzhou	0.547	5

4.2 Analysis

From the overall results, Beijing ranks first among the five cities, Shanghai, Shenzhen and Hangzhou rank second, third and fourth, and Guangzhou ranks last; In terms of specific values, Beijing's value is much higher than that of other cities, and it performs well in terms of innovation environment, innovation resources and innovation achievements; As China's economic center, Shanghai ranks second in overall suitability, Shenzhen ranks third, and Guangzhou and Hangzhou perform poorly.

(1) Evaluation and Analysis on the suitability of Beijing Regional Innovation Ecosystem

It can be concluded from the table that Beijing has advantages in innovation species, innovation environment and innovation resources, "high-tech enterprises", "colleges and universities", "total expenditure of social R & D funds", "full-time equivalent of R & D personnel", "patent authorization", "turnover of technology market", "total expenditure of education funds" Many ecological factors such as "total social retail consumption" and "domestic and foreign currency deposits of financial institutions" are in the best niche, gathering a large number of innovative talents, institutions, funds, technology and other innovative elements, which provides Beijing with good basic conditions for innovation and innovation sustainability, so that Beijing may maintain a leading position for some time in the future.

(2) Evaluation and Analysis on the suitability of Shanghai Regional Innovation Ecosystem

As China's economic and cultural center, Shanghai has made good achievements in innovation in recent years. It ranks second in niche suitability, second only to Beijing, and performs well in innovation resources, innovation vitality and innovation efficiency. It is in the best niche in terms of "full-time teachers in Colleges and universities", "science and technology incubator", "added value of high-tech industry", "added value of information industry", "per capita disposable income of urban residents" and "per capita living consumption expenditure of urban residents".

(3) Evaluation and Analysis on the suitability of Guangzhou regional innovation ecosystem

Guangzhou's niche suitability is almost the same as that of Hangzhou, and they are all at the bottom. In terms of key innovation indicators such as "high-tech enterprises", "total expenditure of social R & D funds", "full-time equivalent of R & D personnel", "patent authorization" and "turnover of Technology market", Guangzhou's regional innovation ability is weak.

(4) Evaluation and Analysis on the suitability of Shenzhen regional innovation ecosystem

Since the reform and opening up, Shenzhen has developed rapidly and gathered a number of innovative enterprises, but there is still a large gap with Beijing and Shanghai in the suitability evaluation. The reason may be that Shenzhen is lack in the number of colleges and universities, the number of full-time teachers in Colleges and universities and the number of college students, but from the perspective of innovation achievements alone. Shenzhen does have good results.

(5) Evaluation and Analysis on the suitability of Hangzhou Regional Innovation Ecosystem

Hangzhou performs well in the three aspects of "per capita disposable income of rural residents", "consumption expenditure" and "added value of information industry", but it still lags behind other cities in other aspects, which is generally poor. In terms of the number of high-tech enterprises, Hangzhou is far lower than Beijing, Shanghai and Shenzhen, and the added value of high-tech industries does not account for a high proportion of industrial added value; In terms of education, Hangzhou currently has 40 colleges and universities, but it is still at a disadvantage and needs to be improved; In terms of scientific research investment, the total expenditure of social R & D funds ranks the lowest, and there are still deficiencies in scientific research investment; In terms of innovation achievements, Hangzhou is weak in terms of patent authorization and technology market turnover, which means that the current number of scientific research achievements in Hangzhou is insufficient, and there are still obstacles and low conversion rate in the transformation of scientific research achievements.

5. Suggests

5.1 Optimizing Innovative Species

At present, Hangzhou has a good foundation of information economy, formed an information economy industrial cluster with Alibaba and Netease as the core enterprises, and has a strong atmosphere of Internet entrepreneurship. Therefore, it is necessary to help the better development of the Internet innovation and entrepreneurship ecology on the existing basis, create an "Internet +" innovation highland with global influence, promote the "Internet +" Application of enterprises, and comprehensively improve the competitiveness of enterprises. First, we need to cultivate a number of leading enterprises with certain strength and can lead the technological progress of the industry, and promote the transformation and upgrading of traditional manufacturing industry to high-end equipment manufacturing and other fields. Secondly, we should cultivate and expand related innovation species, form a complete industrial chain from the spatial and geographical level, build a complete value chain in the industrial chain, and drive the value-added of the whole industrial chain and even the whole value chain by cultivating related innovation populations, so as to realize the scale agglomeration effect of related innovation clusters on the whole innovation cluster. Moreover, we should learn from the experience of Shenzhen, improve the capacity of local research institutions, strengthen cooperation with other universities, introduce scientific research institutions into

Hangzhou, support the development of local scientific research institutions and improve the openness of regional innovation ecosystem.

5.2 Gathering Innovation Resources

First, we will introduce a talent introduction mechanism, unite developed regions at home and abroad to introduce high-end talents, and innovate the way of introducing high-end talents through the coordinated efforts of the demand side, supply side and service side; Second, gather high-end scientific and technological innovation resources, strengthen the construction of national strategic scientific and technological forces, build major scientific research platforms, gather universities and scientific research institutions, output scientific and technological achievements and improve the conversion rate of scientific and technological achievements.

5.3 Create a Good Innovation Environment

First, as an important part of creating an innovation environment, the government should change the governance mode, lead to the formation of multi-agent symbiotic collaborative governance, let all innovation subjects form benign interaction and activate the innovation vitality of regional innovation ecosystem; Make use of the unique strategy and foresight of the government to establish a good institutional system, so as to optimize the innovation environment. Second, establish an exchange mechanism, cooperate and exchange with domestic cities with better development, establish an information sharing mechanism, promote the cooperation of scientific research institutions and improve the conversion rate of scientific and technological achievements. Similarly, it is also necessary to establish a connection with foreign innovation areas, gather global innovation resources and production factors, and learn foreign advanced technology; Third, improve the innovation service system, change government functions, build a service-oriented government, and let more government departments participate in innovation governance, so as to realize the sharing of innovation resources and drive the development of small and medium-sized enterprises.

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