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Retraction

Retracted: Application of Media Integration in the Construction of Scientific and Technological Innovation Ecological Chain

Advances in Multimedia

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This article has been retracted by Hindawi, as publisher, following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of systematic manipulation of the publication and peer-review process. We cannot, therefore, vouch for the reliability or integrity of this article.

Please note that this notice is intended solely to alert readers that the peer-review process of this article has been compromised.

Wiley and Hindawi regret that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] J. Liu, "Application of Media Integration in the Construction of Scientific and Technological Innovation Ecological Chain," *Advances in Multimedia*, vol. 2023, Article ID 5855214, 11 pages, 2023.

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Research Article

Application of Media Integration in the Construction of Scientific and Technological Innovation Ecological Chain

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With the recent international economic and social changes, the development of innovation theories, the changes in the global industrial structure, and the transformation of old and new kinetic energy, many countries have advanced from innovation paradigm 1.0 to 3.0, integrating a variety of disciplines and theories, and using this concept to enhance their innovation capabilities. In such an environment, how to combine scientific and technological innovation with ecological environment construction, practice the integration and symbiosis of ecology and innovation, and promote the development of green innovation is the current focus of academic research. The scientific and technological innovation ecological chain is an organizational model that realizes the goal of scientific and technological innovation and the value-added spiral through the orderly connection and synergistic interaction between the main bodies or elements of innovation, such as basic research, technical research, achievement transformation, talent support, and technological finance. This paper takes Shanxi Province's scientific and technological innovation ecological chain as a typical example, collects relevant text data through web crawler technology, then deconstructs the system of scientific and technological innovation ecological chain based on media integration, understands the composition of its main chain, supporting chain, and the interaction between the chains mechanism, and finally puts forward policy suggestions for the deepening of the future regional scientific and technological innovation ecological chain.

1. Introduction

On May 28, 2021, the general secretary Xi pointed out in his speech at the 20th Academician Conference of the Chinese Academy of Sciences, the 15th Academician Conference of the Chinese Academy of Engineering, and the 10th National Congress of the Chinese Association for Science and Technology that the world economy is in a downturn, the global industrial chain and supply chain are facing reshaping, and instability and uncertainty have increased significantly. To promote the integration of innovation chain and industry chain, the key is to establish the dominant position of enterprises in innovation. With the recent international economic and social changes, the development of innovation theories, the changes in the global industrial structure, and the transformation of old and new kinetic energy, many countries and regions choose to use the concept of "innovation ecological chain" to reposition and think about their own in the field of scientific and technological innovation [1]. The innovation ecological chain originates from the innovation ecological theory, which means that the innovation subjects are linked and interdependent, forming an unbreakable food chain. The diversity and balance of the whole ecology must be maintained, so as to achieve the healthy, coordinated, and sustainable development of the innovation ecology. The development of innovation, from innovation paradigm 1.0 to 3.0, integrates a variety of disciplines and theories, combined with its own actual situation, and uses this concept to improve its own scientific and technological innovation capabilities [2].

The 21st century is an era in which knowledge creates economic value [3]. The global industrial structure and economic growth mode have undergone earth-shaking changes [4]. Innovation is an important driving force in the development of the new normal economy [5]. The

innovation of science and technology promotes product upgrades, industrial restructuring, and adjustment, and economic development achieves a qualitative leap [6]. The development of regional innovation is inseparable from the promotion of scientific and technological innovation, and at the same time, it is also inseparable from the protection of the ecological environment [7]. In recent years, the concept of "innovation ecological chain" has been proposed, which has become a research hotspot of scholars across the country [8].

Since Moore first introduced the "ecological chain" into the business field in 1993, Ander took the lead in researching the "innovation ecological chain" in 2006 [9]. He believes that the essence of the development of innovation ecological chain focuses on dependency and complementarity and analyzes the innovation activities and development strategy choices of enterprises from the perspective of these two analyses [10]. In 2011, the Ministry of Science and Technology of China held a roundtable meeting on the topic of "Innovation Ecological Chain" [11]. The following year, the Shanxi Provincial Government proposed the policy of "Building a Vibrant Innovation Ecosystem" [12]. After the "Thirteenth Five-Year Plan," Tianjin, Jiangsu, Zhejiang, and other places have successively issued relevant policies and measures on building an innovation ecological chain and put them into practice in innovation activities [13]. It can be seen that in the critical period of China's economic structure development and industrial upgrading and transformation, the demand for the construction of the innovation ecological chain has been further increased [14].

Basic research is not only the source of scientific and technological innovation but also the forerunner of the ecological chain of scientific and technological innovation [15]. Shanxi Province has carried out the reform of the scientific research system through legislation and has continuously strengthened its basic research capabilities through the construction of scientific research carrier infrastructure [16]. In terms of legislative guarantee, Shanxi Province has promulgated the "Shanxi Provincial Basic Research Project Management Measures" and "Shenzhen Special Economic Zone Science and Technology Innovation Regulations" (hereinafter referred to as the "Regulations"), which are the first in the country to form a long-term sustainable and stable investment mechanism for basic research. Among them, the "Regulations" are the first local regulations in China dedicated to the construction of the whole-process scientific and technological innovation ecological chain [17]. It is stipulated in a statutory form that the funds invested by the government in basic research and applied basic research shall not be lower than 30% of the municipal-level scientific and technological research and development funds [18]. At the same time, the "Regulations" also stipulate that through the establishment of municipal natural science funds, enterprises and other social forces to set up funds and other diversified channels to increase investment in basic research [19].

Therefore, it is urgent to improve the technological innovation capability of enterprises and make enterprises the main body of technological innovation through the combination of independent innovation and cooperative innovation [20]. However, due to the inertia of the planned economy in the scientific research system, research in scientific research institutes and universities is often self-contained. Since research and production belong to different units, the goals of the two are inconsistent, and research and production are often disconnected, resulting in "market failure," the embarrassing situation of "two skins" in the economy and technology is not conducive to the implementation of the innovation-driven development strategy [21].

In addition, industrial transformation has reconstructed the global innovation landscape and reshaped the global economic structure. New businesses and technologies are brewing new industrial changes [22]. Only technological innovation, without the ability to commercialize and industrialize it, cannot promote industrial development and economic growth [23]. This requires the deep integration of advanced manufacturing and technological innovation. However, most new technological innovations are established. On the basis of existing science and technology, breakthroughs are made in the field of comprehensive and multidisciplinary knowledge, which requires large investment, long cycle, and high risk, which has higher requirements for elements such as funds, talents, and management experience [24]. The traditional industry-university-research cooperation model is difficult to satisfy, and innovation entities and supporting institutions are required to establish long-term and stable cooperative relations.

2. Materials and Methods

2.1. Overview of the Ecological Chain of Scientific and Technological Innovation. In the natural field, ecological chain refers to the interaction between organisms and their living environment and between organisms, forming an indivisible natural group through material circulation, energy flow, and information exchange, with the characteristics of closed-loop flow of material and energy. With the intersection and integration of interdisciplinary ideas, the core connotation of the ecological chain has gradually been applied to the fields of commerce, industry, information communication, etc., forming emerging development models such as industrial ecological chain, intelligent logistics ecological chain, business network information ecological chain, and data ecological chain. In the field of scientific and technological innovation, applying the core connotation of the ecological chain to the process of scientific and technological innovation has formed an emerging model of scientific and technological development—the ecological chain of scientific and technological innovation.

The scientific and technological innovation ecological chain refers to the organizational model that realizes the goal of scientific and technological innovation and the value-added spiral through the orderly connection and synergistic interaction between the main bodies or elements of innovation. Today's scientific and technological innovation is not only a competition of key technologies but also a competition of innovation systems. Only when all

links and elements in the innovation chain work together and the innovation ecology prospers can we achieve a comprehensive breakthrough in scientific and technological innovation. It means focusing on R & D investment, science and technology carrier, innovation subject and achievement transformation, considering and promoting every link of science and technology R & D as a whole, and grasping the key and key to scientific and technological innovation. At present, some provinces and cities in China have preliminarily constructed a scientific and technological innovation ecological chain based on regional characteristics. For example, Shaanxi Province focuses on accelerating the in-depth integration of the industrial chain and innovation chain and strives to create a scientific and technological innovation ecological chain of "scientific and technological talents + achievement transformation + enterprise innovation + scientific research platform + service system"; Sichuan Province Chengdu City has advanced industrial basic capabilities. The modernization of the entire industrial chain and the regionalized industrial ecosystem of supply facilities are the core, and efforts are made to build an innovative ecological chain of "basic research + technical research + achievement transformation + industrial cultivation."

However, the technological innovation ecological chain in most provinces and cities is in the process of construction, and there is no typical successful case except Shenzhen. On May 15, 2021, the first session of the Seventh National People's Congress of Shanxi Province announced that Shanxi Province has taken the lead in establishing a whole-process scientific and technological innovation ecological chain in the country, realizing the historic transformation and systematic reconstruction of the innovation system. On July 21, 2021, the National Development and Reform Commission issued the "Notice on Promoting and Learning from Shenzhen Special Economic Zone's Innovative Measures and Experiences" to promote and encourage reference to the process innovation ecological chain established in Shanxi Province.

This study takes Shanxi Province as an example and collects relevant text data on the ecological chain of scientific and technological innovation through web crawler technology. On this basis, the system of the scientific and technological innovation ecological chain is systematically deconstructed through text analysis methods and rational suggestions are put forward for its future deepening development.

2.2. Deconstruction Research on the Ecological Chain of Scientific and Technological Innovation

2.2.1. The Main Chain of the Scientific and Technological Innovation Ecological Chain. The innovation ecological chain is mainly formed by the policy chain that promotes the landing of scientific and technological innovation achievements, the service chain that ensures the efficient operation of market innovation formats, the platform chain that promotes the free integration of innovation and entrepreneurship carriers, the industrial chain that supports the continuous development of innovation and entrepreneurship ecology, and the financing chain that prides the vitality of innovation and entrepreneurship entities. The multichain is "coupled". The main chain of the scientific and technological innovation ecological chain is composed of three key activities: basic research, technical research, and industrialization of achievements, which jointly deduce the whole process of "0-1-N" growth of scientific and technological innovation (see Figure 1).

2.2.2. The Supporting Chain of the Scientific and Technological Innovation Ecological Chain. Technological finance and talent support are the supporting chains of the technological innovation ecological chain (see Figure 2). Technological finance ensures the supply of capital for technological innovation, and talent support guarantees the supply of intelligence. The two are the "wings" that ensure the takeoff of the technological innovation ecological chain.

Science and technology finance is a resource system for the government, financial institutions, and venture capital institutions to provide supporting financial products, services, and policy support for innovative entities such as enterprises engaged in R&D innovation, achievement transformation, and industrialization. The input system is a strong support for ensuring the explosion of innovation power in the scientific and technological innovation ecological chain. In the way of government guidance, it needs to focus on creating a number of venture capital funds to provide financing services for the development of start-ups, such as providing support in business model, technology and system innovation, strategy, capital, and governance. At the same time, banks are encouraged to support venture financing, explore the establishment of several industry guidance funds, build a financing chain for innovation and entrepreneurship, build a foundation for high-quality development of innovation and entrepreneurship, and inject "water" needed by innovation ecology.

In this regard, Shanxi Province has ensured long-term stable support for technology finance through multiple channels. In terms of legislative guarantees, the regulations clearly propose to establish a fund system covering seed-stage investment, angel investment, venture capital, mergers and acquisitions, and reorganization investments through government guidance and market cultivation; increase the preferential tax treatment for venture capital investment by technology-based enterprises and special fund subsidy quotas; and improve the risk prevention and resolution of the financial market for technological innovation and the classification and supervision mechanism. In addition, Shanxi Province also issued a number of policies such as the "Shanxi Province Technology Transfer and Achievement Transformation Project Funding Management Measures" to effectively implement capital investment in the transformation of scientific and technological achievements and the growth of scientific and technological enterprises.

The scientific and technological innovation ecological chain is not a simple listing of innovation subjects or

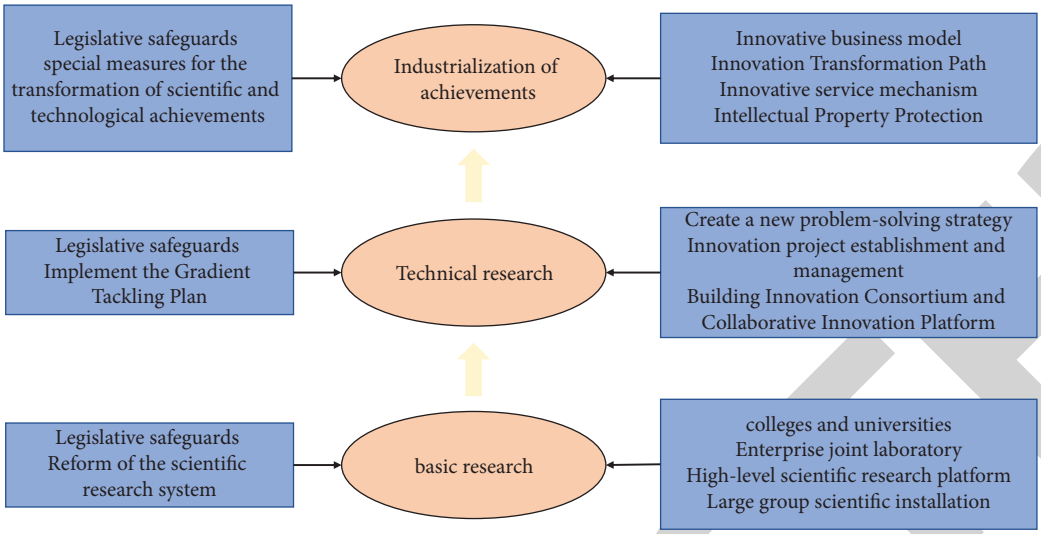

Figure 1: Main chain of the scientific and technological innovation ecological chain.

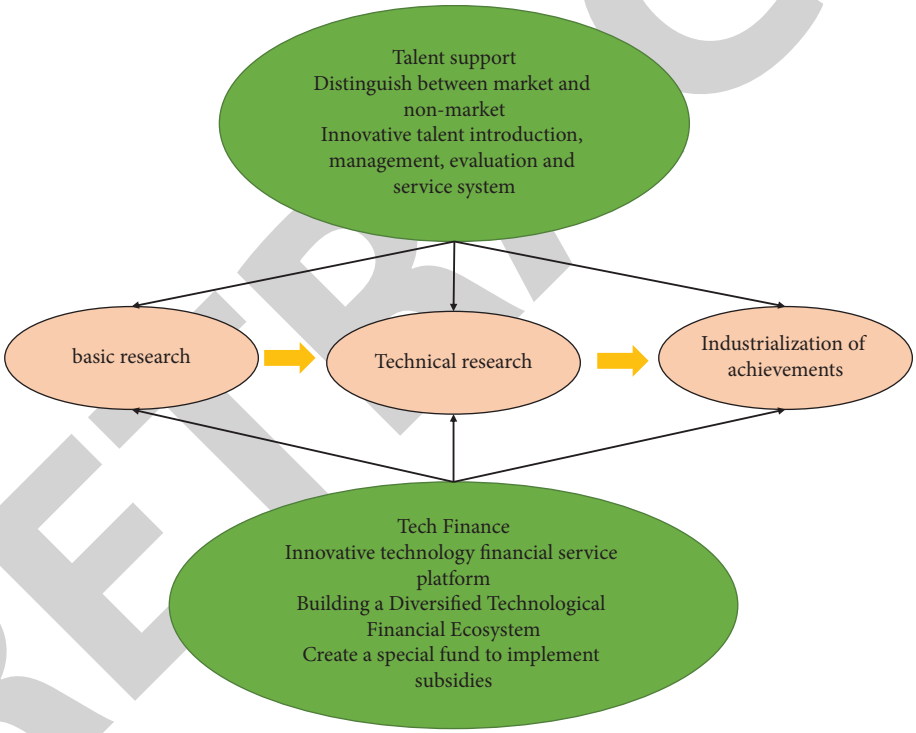

Figure 2: Supporting chain of the scientific and technological innovation ecological chain.

elements, but it is an orderly connection and collaborative interaction of the chain, which can fully stimulate the functions and potentials of various innovation elements to add value, and finally realize a spiral rise and a continuous organic cycle of scientific and technological innovation activities. In this process, the embedding of innovation chain, talent chain, capital chain, technology chain, and closed-loop feedback chain realizes the organic connection of innovation elements and promotes the formation of a scientific and technological innovation ecological chain. In the whole-process innovation ecological chain of "basic research + technical research + achievement industrialization + technology finance + talent support," first of all, the integration of basic research and technological research has formed an innovation chain. Schools and scientific research institutes have formed an innovation consortium to carry out collaborative innovation. In a certain industry, enterprises, universities, scientific research institutions, and the government cooperate with each other, give play to their respective advantages, and form an innovation chain combining industry, government, learning, and research. According to market demand and government guidance, enterprises put forward human resources and

knowledge innovation requirements to universities, obtained research and development achievements or patented technologies from scientific research institutions, searched for technical information or intermediary services from scientific and technological intermediaries, obtained financial support from financial investment departments, and participated in one or more innovation links such as product development and design and marketing on this basis, finally forming market-oriented innovation. The innovation chain not only promotes the expansion of research depth and research horizons in basic disciplines but also accelerates the overcoming of difficulties and breakthroughs in "high-end" technologies and "stuck neck" technologies.

Secondly, the integration of technical research and achievement transformation has formed a "scientific research-transformation-industry" technology chain. The construction of the innovation and entrepreneurship complex of "laying eggs along the way" has realized the rapid industrialization of scientific and technological innovation achievements. Finally, the connection between the industrialization of achievements and basic research is the key process to realize the closed-loop management of the ecological chain of scientific and technological innovation. The industrialization of achievements has promoted the formation of the main body of innovation consisting of high-tech zones, high-tech enterprises, and high-tech industries. It is not only the core element to drive high-quality economic development but also an important source of scientific and technological innovation funds and human resources. Industrialization of achievements means that many achievements, when they appear, do not have economic attributes, commercial purposes, and industrial needs. However, with the iterative development of technological progress, the market and enterprises have put forward demands for the industrialization of achievements. Compared with technology tackling, the industrialization of achievements only depends on "whether the technology is present and mature." If the technology is not mature and cannot be achieved, it may have to be traced back to the link of "technical breakthrough" according to the intensity of demand and the size of interests.

2.3. In-Depth Promotion of Media Integration. The deep integration of media and the dissemination of scientific and technological innovation are mutually successful. The reason for promoting the deep integration of media is that scientific and technological innovation has brought revolutionary changes to media communication, and "four Omnimedia" has become a reality. Therefore, the deep integration of media is inevitable. On the other hand, communication in the field of science and technology must also be realized through the deep integration of media; otherwise, it will not achieve the ideal efficiency because this is a new era.

The era of media integration is an era of deep integration between traditional media and new media, including content, form, and channels, and its core is "integration." Therefore, the fusion of the two needs to achieve an effective fusion and complementary effect. For news reports, on the one hand, the in-depth advancement of media integration makes the form of online live broadcasts increasingly appear in news reports. For example, the convening of the Two Sessions, the progress of the epidemic, the Olympic Games, etc., this kind of news live broadcast from the first perspective has become an indispensable communication role in hot events. On the other hand, traditional mainstream media such as People's Daily are also actively trying to use live webcasts for news reporting and comply with the requirements of the era of media integration, create their own new media platforms, create official new media accounts, and provide users with professional real-time news report.

Under the background of the deep integration of media, the media use live webcast as a communication tool for long-term development, which effectively promotes the informatization development of news reports; thus, forming a new situation for the development of webcast news. The in-depth integration of media has brought about three-dimensional and diversified changes in news live broadcast. The public's demand for real-time news information has been stimulated unprecedentedly, and online news live broadcast may become an indispensable work method for news media.

Scientific and technological innovation communication has two meanings, one is to take "scientific and technological innovation" as the content of communication, and the other is to take "scientific and technological innovation" as the technical means of communication. First, do a good job in the training of media personnel in science and technology enterprises, improve their ability to communicate scientific and technological innovation, and build a science and technology financial media center on the basis of training. Second, in view of the impact of scientific and technological innovation on high-quality economic development and people's quality of life, we will regularly launch a number of influential and iconic scientific and technological products, so that the whole society can share the achievements of scientific and technological innovation, and promote China's independently innovated scientific and technological achievements to the world. Third, through the introduction of a number of prominent and iconic scientific and technological figures, the dissemination of scientific and technological ideas and the scientific spirit will enhance the good atmosphere in which the whole society respects scientific and technological talents and advocates scientific and technological innovation.

3. Results and Discussion

3.1. Construction of Niche Model. If the niche derived from ecological inheritance remains stable (i.e., the process of ecological inheritance is maintained from generation to generation), then the organism will face new selection pressure and generate new adaptation forms, which will make the organism further modify the current niche. Correspondingly, this also means that the environment can evolve like an organism. Therefore, Niche Construction

Theory (NCT) is essentially a feedback process, which can bring evolutionary significance.

Due to the large differences in the dimension and order of magnitude of the index data, all data were standardized for the smooth development of the follow-up research. Assuming that there are m innovation ecosystems (4 provinces are selected in this paper) and there are n ecological factors in the evaluation index system (23 indicators are selected in this paper), it can be recorded as X_j ($j = 1, 2, 3, \ldots, n$). By collecting and sorting out the specific values of the relevant evaluation indicators, the judgment matrix can be obtained:

$$R = \left(r_{ij}\right)_{m*n}. \tag{1}$$

Among them, r_{ij} represents the value of the Lth ecosystem on the jth ecological factor because different index units have great differences; in order to eliminate the dimensional influence of different orders of magnitude, the extreme value method is used to standardize the judgment matrix:

$$r'_{ij} = \frac{r_{ij} - \min_i \left|r_{ij}\right|}{\max_i \left|r_{ij}\right| - \min_i \left|r_{ij}\right|}. \tag{2}$$

The judgment matrix after dimensionless processing is obtained as follows:

$$R' = \left(r'_{ij}\right)_{m*n}. \tag{3}$$

The standardized judgment matrix is obtained, and the information of each ecological factor is calculated as follows:

$$e_j = -\frac{1}{\ln m} \sum_{i=1}^{m} k_{ij} \ln k_{ij}, \tag{4}$$

in,

$$k_{ij} = \frac{r'_{ij}}{\sum_{i=1}^{m} r'_{ij}}. \tag{5}$$

The weight of the jth ecological factor can be obtained as follows:

$$\omega_j = \frac{1 - e_j}{n - \sum_{j=1}^{n} e_j}. \tag{6}$$

The niche suitability model determines:

$$F_i = \sum_{j=1}^{n} \omega_j \frac{\delta_{\min} + \alpha\delta_{\max}}{\delta_{ij} + \alpha\delta_{\max}}. \tag{7}$$

Among them, F represents the ecological niche suitability value, and the value of the value is proportional to the level of system innovation activity; ω_i is the ecological factor weight; x' is the value after standardization of the original data; x' represents the jth ecological factor optimal value; and $S_{ii} = x_i - x_{ai} (i = 12, \ldots, m, j = 12, \ldots, n)$ represents the absolute difference, where αE[0,1] is the model parameter, calculated when $F = 0.5$:

$$\overline{\delta_{lj}} = \frac{\sum_{i=1}^{m} \sum_{j=1}^{n} \delta_{ij}}{mn}, \tag{8}$$

so

$$a = \frac{\overline{\delta_{lj}} - 2\delta_{\min}}{\delta_{\max}}. \tag{9}$$

KM' is used to measure the evolutionary space of niche suitability, and the formula is follows:

$$\mathrm{KM}_i = \sqrt{\frac{\sum_{j=1}^{n} \delta_{ij}}{n}}. \tag{10}$$

According to the above steps, $F_i E$ [0, 1] can be derived, and the closer to 1, the closer the niche suitability is to the optimal state.

3.2. Data Processing Methods. Before carrying out the coupling coordination analysis, it is necessary to calculate the index weight. There are many calculation methods. Next, we will briefly introduce several methods to attach weights to the index.

First, standardize the data and use the extreme value method, which is the same as the method used to construct the niche suitability model. Next, the method of attaching weights to indicators is introduced, and three commonly used methods are selected here.

3.2.1. Analytic Hierarchy Process (AHP). AHP is a combination of quantitative and qualitative analyses proposed by American operation researcher Satty et al. appropriate decision-making method. The characteristic of this method is that the thinking process of decision-making is mathematicalized, including a variety of decision-making criteria, complex problems are constructed in a hierarchical structure model, and then a small amount of quantitative information is used to make decisions. The method solves some problems in decision-making, evaluation, and prediction by establishing a hierarchical structure composed of a target layer, criterion layer, and scheme layer. The specific calculation steps are as follows: ① construct a ladder hierarchy to analyze the essence, influencing factors, and internal relationship of the target problem, and construct a ladder hierarchy based on this. Structure connects internal factors. ②Establish a comparison judgment matrix based on the hierarchical structure model and establish a pairwise comparison judgment matrix. CK, A1, A2, …, An, these values are the indicators of factors that have a dominant relationship with CK and the relative importance of the relationship. It is assumed that each single-level target factor is the importance of the pairwise relative relationship obtained by comparing AI and Aj.

3.2.2. Entropy Weight Method (Entropy Value Method). The larger the entropy is, the more chaotic the system is, the less information it carries, and the smaller the weight; otherwise, the conclusion is the opposite. The main steps of

entropy weight method with weight are divided into the following three steps:

① Data standardization: due to the different data dimensions, the use of the original data for measurement will affect the evaluation results, so the data need to be normalized.

② Obtain the information of each index.

③ Determine the weight of the index, and the direct value method assigns the weight according to the difference degree of the sign value of each index, so as to obtain the corresponding weight of each index.

3.2.3. Principal Component Analysis. The principal component analysis method is a statistical method of dimensionality reduction. A statistical method reflects the information of the original variable more than once.

3.3. Establishment of Coupling Coordination Model. Coupling and coordinated development is the main feature of the current innovation ecosystem development. The essence of the coordinated development of the innovation ecosystem is to connect, cooperate, and interact with each other within the region to achieve the goal of the overall development of the region, so as to jointly promote a virtuous circle of development. Coupling refers to the degree to which two or more systems interact and influence each other. The formula for calculating the coupling degree of the two systems is as follows:

$$C = \frac{2\sqrt{U_1 \times U_2}}{U_1 + U_2}. \tag{11}$$

In the formula, C represents the degree of misfortune and U1 and U2 represent the comprehensive development level of the technological innovation subsystem and the ecological environment subsystem, respectively. Suppose, among the g indicators, s items belong to the technological innovation system, then there are

$$\begin{aligned} U_1 &= \sum_{i=1}^{S} w_g x_{ig}, \\ U_2 &= \sum_{i=g-s}^{g} w_g x_{ig}. \end{aligned} \tag{12}$$

The coupled coordination model is as follows:

$$D = \sqrt{C \times T}. \tag{13}$$

In the formula, D represents the coordination degree of misfortune and T is the comprehensive evaluation index of the subsystem, where

$$T = \alpha U_1 + \beta U_2, \tag{14}$$

α and β represent the undetermined coefficients of the two subsystems,

$$\alpha + \beta = 1. \tag{15}$$

Based on the research of previous scholars and the reference of relevant literature, combined with the characteristics of Chinas regional economic development, it is believed that technological innovation and ecological environment are equally important, so set $\alpha = \beta = 0.5$.

4. Experimental Results and Analysis

4.1. Analysis of Empirical Results. First, the data of Shanxi Province from 2011 to 2018 were standardized by the range method and normalization, and then the entropy weight method was used to assign weights to the indicators. Finally, the niche suitability model was used to calculate the suitability. For the specific calculation results, see Figure 3.

According to the longitudinal calculation results of Shanxi Province, it can be seen that the niche suitability of the innovation ecosystem is relatively low and is in the first stage, but it can be seen that the change of its suitability is increasing year after year. time, and a buffer period is needed to adapt to a certain level, and small fluctuations are normal. The niche suitability was in a steady upward stage from 2011 to 2013 and decreased slightly from 2014 to 2015, but the fluctuation was small. Among them, "R&D input intensity, per capita water resources, total investment in environmental pollution control, and new products in high-tech industries" sales revenue and the number of foreign technology import contracts have continued to decline. In 2014, the "technology market turnover" slightly declined. In 2015, the "urban population density, CO2 emissions, per capita GDP, R&D personnel equivalent full-time equivalent, and total import and export" were dropped. The suitability was higher than 0.5 in 2016 and then decreased slightly from 2017 to 2018, with a small decrease. It can be judged that the innovation ecosystem of Shanxi Province is currently in a critical period of transition from stage one to stage two, and many factors need to be further improved. The internal and external environment needs to be further improved until it becomes stable.

The three regions of Beijing, Tianjin, and Hebei were standardized and weighted according to the same calculation method, and then the niche suitability was calculated. The final calculation results are shown in Figure 4.

Compared with "Beijing-Tianjin-Hebei," there is a certain gap in the development of innovation ecosystem in Shanxi Province. Generally speaking, the ecological niche suitability of the four regions is "Beijing, Hebei, Tianjin, and Shanxi," which is in a descending order. From 2017 to 2018, the niche suitability of Shanxi was slightly higher than that of Tianjin. From the specific indicator data, in 2011, in terms of innovation entities, the "number of R&D enterprises" in Shanxi Province was significantly lower than that of the other three regions, and the gap ranged from 300 to 800 in the same period. There is a big lack of power. Among the basic ecological resources, Shanxi's overall performance is average, and the "R&D input intensity" needs to be strengthened.

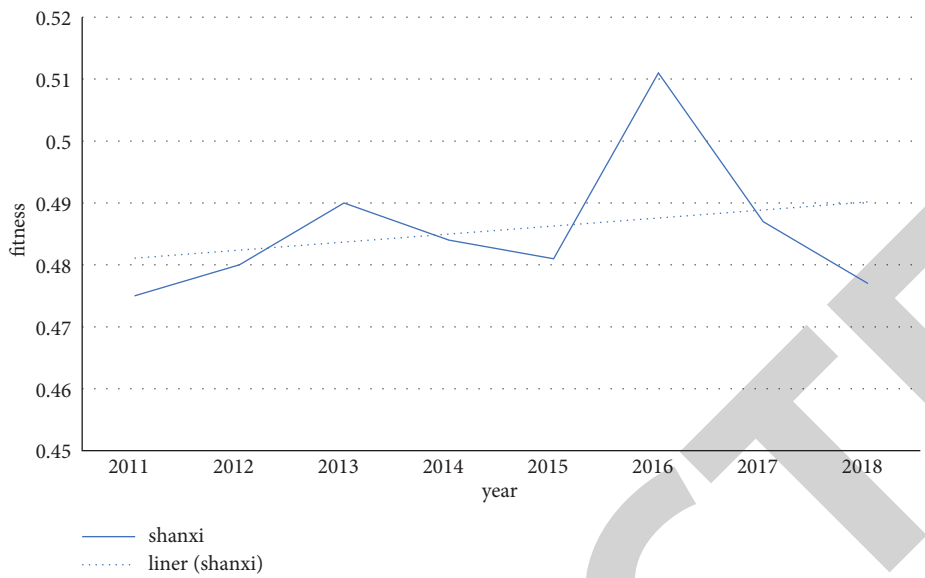

Figure 3: Changes in the niche suitability of innovative ecosystems in Shanxi Province from 2011 to 2018.

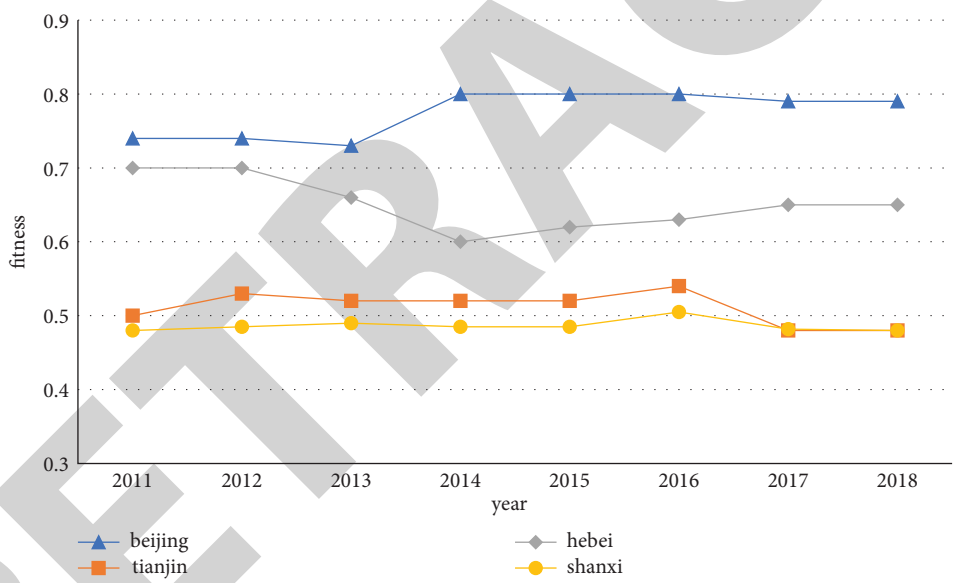

Figure 4: Comparison of changes in niche suitability from 2011 to 2018.

4.2. Calculation of Coupling Coordination Degree and Coordination Level and Mode. After the weight of each indicator is calculated, it is brought into the coupling model to calculate the coupling coordination degree, and the coupling coordination level and coordination mode in different years in each region are put together for comparison according to the classification. The results are as Figure 5 shows.

According to the calculation results, it can be seen that from 2014 to 2016, the coupling coordination degree of Shanxi is slightly higher than that of Tianjin. According to the analysis of objective and realistic reasons, the occurrence of this situation will be slightly inconsistent with reality. So there is a need to find out why. After the verification of the original data, it was found that in the past few years, Shanxi's "number of full-time teachers in higher education institutions, number of colleges and universities, Internet broadband access, financial education funds, number of R&D institutions, green coverage rate in built-up areas, and per capita park green space" are slightly higher than those of Tianjin. Although the calculated result of Tianjin is slightly lower than that of Shanxi, it does not mean that Tianjin's development lags behind that of Shanxi. It can only represent that the coupling between subsystems in Shanxi is better than that in Tianjin, and the actual development situation of Tianjin is much higher than that of Shanxi.

4.3. Analysis of Media Convergence. In 2018, according to the main activities, the enterprise expenditure was 1,523.37 billion yuan, accounting for 77.4% of the total R&D expenditure. From the perspective of the structure of research and development funds, the research and development

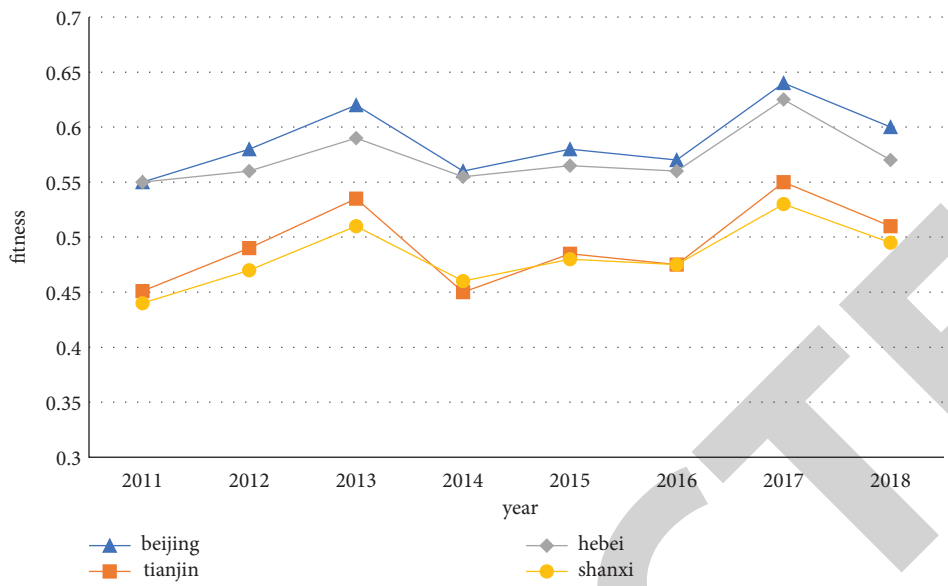

Figure 5: Line chart of changes in coupling coordination degree from 2011 to 2018.

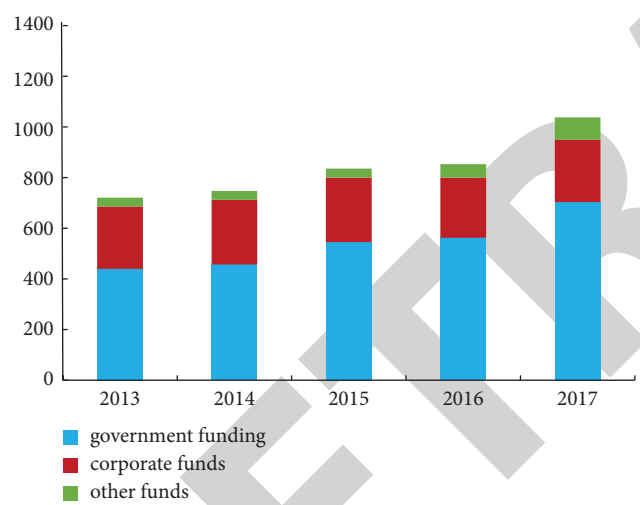

Figure 6: Sources of science and technology funding in Chinese universities from 2013 to 2017.

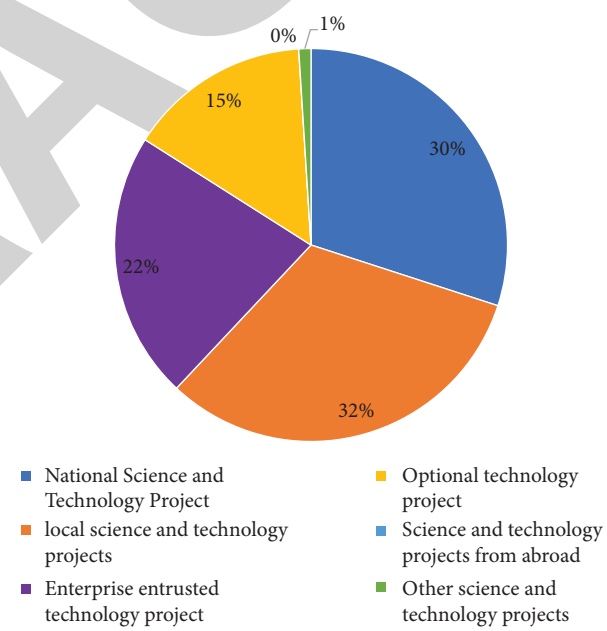

Figure 7: 1017 R&D projects in colleges and universities (by source).

funds invested by enterprises have accounted for nearly 80% of the total funds and have become the main body of China's scientific and technological research and development. However, more than 90% of the R&D expenditure of enterprises is insufficient in basic research and applied research in terms of experimental development. In 2017, the internal expenditure on R&D funds of 2,631 universities across the country reached 126.6 billion yuan, of which government funds accounted for 63.5% and enterprise funds accounted for 28.5%. As can be seen from Figure 6, from 2013 to 2017, government funding increased by 28.76 billion yuan, while corporate funding grew slowly, only increasing by 7.11 billion yuan.

In 2017, the number of R&D projects in universities reached 967,000 (items), of which only 22% were projects commissioned by enterprises, and 62% were scientific and technological projects from national and local governments, as shown in Figure 7.

As can be seen from Figure 7, although enterprises have become the main body of R&D in China, in terms of the practice of technological innovation activities, the main role of enterprises is not obvious. According to the interview results of some enterprises, the main body status is more obvious in R&D investment and the transformation of technological achievements. In terms of technological innovation decision-making and scientific research activities, the main body role is generally not reflected, especially the selection and demonstration of scientific and technological

projects by the state and the government. Most of the project reviews come from experts from the government, universities, and research institutions. Enterprises have little right to speak, and more of them play the role of financial participants. It is difficult for technology projects to reflect enterprise needs and market needs. For example, among the top ten major civil science and technology projects, there is only one project led by an enterprise.

5. Conclusion

This study selects data from 2011-2018 in Shanxi Province, Beijing City, Tianjin City, and Hebei Province, constructs an indicator system of innovation ecosystem, and uses the niche suitability model to measure suitability and conduct research from vertical and horizontal directions. In order to fully understand whether the main factors affecting the technological innovation ecosystem are caused by technological innovation or the ecological environment, the technological innovation ecosystem is divided into technological innovation subsystems and ecological environment subsystems, and a coupling coordination degree model is constructed to calculate the relationship between the two subsystems. By coupling coordination relationship, calculating the coupling coordination degree, coupling level, and mode of the four regions of "Beijing-Tianjin-Hebei-Shanxi" from 2011 to 2018, we came to the following conclusions: a series of more specific and comprehensive policies and measures have been introduced for the construction of the scientific and technological innovation ecological chain, and the coordination among various policies such as basic research, technological research, and achievement transformation has been strengthened. Vertically, it is necessary to strengthen the multilevel synergistic relationship of "central government-province-city-locality," and horizontally, it is necessary to build a collaborative network between departments such as science and technology, education, finance, and housing and enterprises, social organizations, and other entities, and at the same time, it is necessary to strengthen. The liaison and cooperation among innovation entities such as science cities, innovation centers, and research institutes in different locations will form an integrated collaborative innovation network with clear themes, interdependent interests, and close collaboration and create a highly competitive innovation ecosystem.

Data Availability

The figures used to support the findings of this study are included in the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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