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Research Article

Research on the Continuous Innovation Driving Mechanism of the Transformation and Upgrading of Traditional Industries

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Innovation-driven transformation and the upgrading of traditional industries is an important task in the present. This paper attempts to further study the existing basis. Based on the perspective of continuous innovation driving, this paper divides the transformation and upgrading of traditional industries into two stages, namely, industrial transformation and industrial upgrading, using the interprovincial data from 2008 to 2019, OLS, HAUSMAN, and SYS-GMM. This paper analyzes the macro- and micromechanism driven by continuous innovation in the transformation and upgrading of traditional industries. The results show that in the macromechanism, the innovation drive has a significant positive effect on the transformation of traditional industries but not on the upgrading of industries, entrepreneurship, network capability, and organizational learning, which significantly affect the transformation and upgrading of traditional industries.

1. Introduction

A large number of traditional industries are widely used, which are the basis of the country's industrial development. Since the sudden outbreak of the new crown epidemic in 2019, traditional industries, which are mainly labor-intensive, have been greatly impacted. Currently, they are facing a severe situation of intensified international competition and an urgent need to speed up the pace of transformation and upgrading. In the "Speech at the Conference on Coordinating and Promoting New Coronary Pneumonia Epidemic Prevention and Control and Economic and Social Development Work" on February 23, 2020, General Secretary Xi Jinping pointed out that traditional industries should be transformed and upgraded by taking this opportunity to cultivate and expand emerging industries. China proposed industrial transformation and upgrading as early as 1998, and many scholars have carried out extensive research on the relationship between technological innovation, industrial transformation, and upgrading, mainly involving the importance of technological innovation [1, 2], the elements of continuous innovation (entrepreneurship, organizational learning, and network capabilities) [3], innovation-driven paths (industrial transfer, industrial agglomeration, and industrial integration), [4] and so on. Zhu [5] expounded the path of intelligent manufacturing to the transformation and upgrading of traditional industries from three aspects, namely technological innovation, technological resources, and human resource aggregation. Tu and Yan [6] divided industrial transformation and upgrading into two types, namely interindustry transformation and intraindustry upgrading. The ratio of the added value of the tertiary industry to the added value of the secondary industry was used to measure the interindustry transformation, hightech industry export delivery value, and the proportion of the region's export trade to measure the appreciation within the industry. It is worth discussing how to use different attribute industries, respectively, in industrial transformation and industrial upgrading.

The transformation and upgrading of traditional industries and the drive of innovation are a long-term continuous process, among which it should be noted that the transformation and upgrading have different connotations, and the drive of innovation is essentially a process of continuous innovation. These two points are not paid enough attention in literature research. Therefore, this paper is for an in-depth study of "innovation-driven transformation and upgrading of traditional industries." The research ideas of this paper are as follows: the continuous innovation mechanism in the process of transformation and upgrading of traditional industries, to promote the transformation of traditional industries to emerging industries, such as hightech, and to promote the evolution (upgrade) of the entire industrial system to pillar industries by vigorously developing the hightech of two stages. The research method is to first build a theoretical model of the driving mechanism of continuous innovation and then to use the provincial panel data in the country to demonstrate the model. The research results will enrich and deepen the theoretical system of innovation-driven industrial transformation and upgrading.

2. Construction of a Continuous Innovation-Driven Model for the Transformation and Upgrading of Traditional Industries

2.1. Periodic Analysis of the Transformation and Upgrading of Traditional Industries. The main body of transformation and upgrading can be microscale enterprises and mesoscale industries, corresponding to the transformation and upgrading of enterprises, [7] industrial transformation, and upgrading [8]. Industrial transformation and upgrading refers to a transition from a low-level form to a high-level form, and the industrial development mode is developed from a low-level to a high-level. Based on the evolution perspective of traditional industries, emerging industries, and pillar industries, this paper further defines the meaning of the transformation and upgrading of traditional industries. The traditional industry is a labor-intensive industry, which is mainly manufacturing and processing. It has the characteristics of large output value, low added value, low demand elasticity, weak risk bearing capacity, and poor technological innovation ability, such as steel, textile, oil, coal, and other industries. New industry is the combination of new technology and new-type industry, taking science and technology innovation as the key point and representing the future development direction of the country's industry. Generally, it has the characteristics of innovation, high risk, high return, high added value, etc. Pillar industry is an industry with important strategic leading position, large-scale share, and important supporting role. It has the characteristics of industrial development potential, driving force, comparative advantage, social employment, and being environment-friendly. The transformation and upgrading of traditional industries refers to the transformation from traditional industries to emerging industries under the action of various internal and external factors, and then from traditional industries or emerging industries to pillar industries by becoming bigger and stronger. The added value of science and technology, on the other hand, cultivates emerging pillar industries and realizes the iterative effect between industries. The analysis of the transformation and upgrading stages of traditional industries is shown in Figure 1. Path ① represents the transformation process of traditional industries, i.e., from traditional industries to emerging industries. Paths ② and ③ represent the upgrading process of traditional industries, i.e., from traditional industries or emerging industries to pillar industries.

2.1.1. Definition of the Concept of Continuous Innovation Drive. The transformation and upgrading of traditional industries are affected by factors, such as finance, policy, and innovation, however, innovation is undoubtedly a very important and fundamental key factor. Since Schumpeter put forward the concept of innovation, the research of continuous innovation theory and innovation-driven development theory on industrial development has always been a hot spot in the academic and practical circles.

Based on the perspective of microenterprise, many scholars have expounded the importance and elements of continuous innovation: Xiang [9] believes that continuous innovation directly determines the success or failure of the strategic goal of innovation, and only persistent innovation can maintain the sustainable development of the organization. Xue conducted a theoretical and empirical analysis on the mechanism, key factors, and ability evaluation of entrepreneurship and organizational learning on continuous innovation [10]. Yu and Lin [3] put forward three elements of continuous innovation, namely entrepreneurship, organizational learning, and network capabilities, and regarded these three elements as the endogenous driving force for the transformation and upgrading of traditional industries.

The research on the role of innovation drive on industrial development from a medium and macro perspective is mainly based on the "innovation function theory." Zhang Yinyin [11] and many other scholars generally agree that innovation drive is also a system engineering, and any system has a certain functional structure. In a broad sense, the functional dimensions of innovation include technological innovation, organizational innovation, institutional innovation, management innovation, business model innovation, business innovation, and cultural innovation. This paper draws on Wei Qingwen's point of view [12] and believes that innovation drive covers three functional dimensions of technological, organizational, and institutional innovation.

There is a consensus that innovation must be sustainable, however, the existing literature has not paid enough attention to innovation-driven sustainability research. In the context of high-quality development, incorporating continuous innovation and innovation-driven research into a unified framework has inherent logical consistency: (1) the goals of the two are consistent. The goals of continuous innovation and innovation-driven research are to change the problems of environmental pollution, energy waste, and ecological imbalance brought about by previous factor-driven methods to achieve high-quality and sustainable

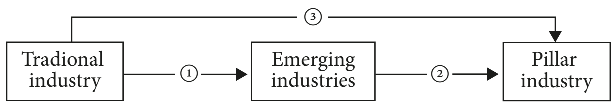

Figure 1: Analysis of the transformation and upgrading stages of traditional industries.

development of the country's economy. (2) The core subjects of the two are the same. Continuous innovation is carried out with microenterprises as the main body, and the sustainable development of enterprises is realized through continuous innovation. Innovation-driven research is carried out in a collaborative innovation method among basic subjects, such as enterprises, universities, and scientific research institutions. The technological innovation system of orientation and combination of production, education and research, continuous innovation, and innovation-driven theory must take the enterprise as the core subject. (3) The organic integration of the two innovative production processes. Among the three elements of continuous innovation, entrepreneurship and its innovative and entrepreneurial activities not only provide the most important human resources in the process of innovation-driven investment but also keenly identify and seize market opportunities and allocate innovative resources to the best innovative production activities. Learning increases the efficiency of innovative production processes through learning experience curves. Network capabilities provide heterogeneous resources for innovative production processes.

Accordingly, based on the perspective of the transformation and upgrading of traditional industries, the concept of continuous innovation drive is put forward, which is as follows: continuous innovation drive is the innovation power provided by the main collaborative innovation subjects, such as enterprises, universities, and scientific research institutions, through entrepreneurship, network capabilities, and organizational learning. Activities, such as technological innovation, organizational innovation, and institutional innovation, promote the continuous development of traditional industries from a low-level form to a high-level form.

2.2. Research Model of Continuous Innovation Driving Mechanism for Transformation and Upgrading of Traditional Industries. According to the above analysis, the continuous innovation drive can be composed of two parts, namely innovation drive and continuous innovation, while the transformation and upgrading of traditional industries can be divided into two stages, namely transformation and upgrading. The function of innovation-driven research to industry is realized through innovation function, which is based on the premise of innovation as the whole function. It belongs to the macrolevel of innovation, while the three elements of sustainable innovation are the power sources of innovation-driven research, which belong to the microlevel of innovation. The continuous innovation-driven transformation and upgrading of traditional industries can be divided into macro and micromechanisms from the perspective of innovation. The macromechanism is to take the continuous innovation drive as a whole and to study the role of the three functions of innovation-driven technological innovation, organizational innovation, and institutional innovation on the transformation and upgrading of traditional industries. The micromechanism is to study the role of entrepreneurship, network capability, and organizational learning in the transformation and upgrading of traditional industries. Among them, entrepreneurship affects the transformation and upgrading of traditional industries at the level of the entire industry, while network capabilities and organizational learning affect industrial upgrading in terms of breaking through the size of the industry but not being strong. There is also an internal connection between the two mechanisms. The development of organizational innovation functions is inseparable from the accumulation of the knowledge of organizational learning elements. The development of technological innovation and institutional innovation functions requires the comprehensive play of the three elements of entrepreneurship, network capabilities, and organizational learning. On the one hand, the three elements of continuous innovation provide a source of driving force for innovation, and on the other hand, they have evolved new features to break through the bottleneck of traditional industry transformation and upgrading. To this end, this paper proposes a research model of the continuous innovation-driven mechanism for the transformation and upgrading of traditional industries, as shown in Figure 2.

3. Study Design

3.1. Research Hypothesis

3.1.1. Macromechanism: Innovation Drives the Transformation and Upgrading of Traditional Industries (Functional Role). Technological innovation can expand the scale of regional industries, increase the share of emerging industries, and promote the transformation of traditional industries through technological diffusion through forward, backward, and side effects. The accumulation of high-level elements, such as technology, process, etc., in the industry makes the industrial structure reasonable, and the technological innovation embedded in different industries can greatly improve the utilization efficiency of innovation resources, reduce environmental pollution, and even turn waste into treasure, such as garbage sorting and recycling, power generation, etc. The "technical" and "innovative" inherent in the innovation drive make the industry more ecological, the industrial environment more suitable, and the national social welfare happier. It promotes the upgrading of traditional industries.

Organizational innovation improves the technical efficiency within the organization through organizational model and value creation, realizes the scale economy of the organization, improves the efficiency of resource allocation inside and outside the organization, and the entire industrial system develops in a coordinated manner, further

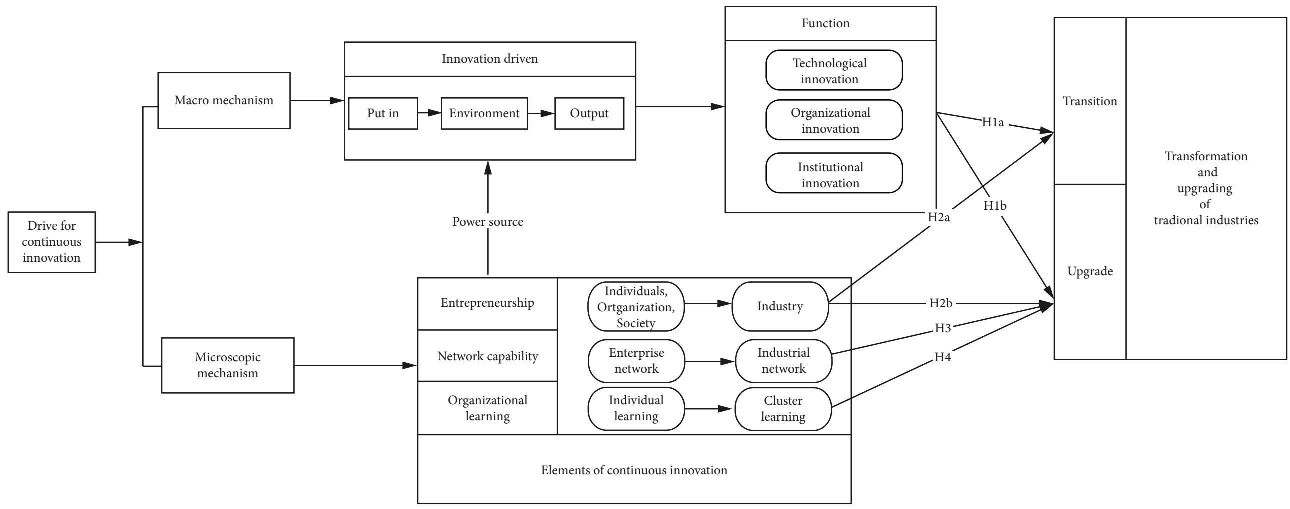

Figure 2: Research framework model.

promoting the transformation and upgrading of traditional industries.

Institutional innovation reduces social transaction costs and opportunistic behavior and stimulates enthusiasm for innovation and entrepreneurship through coercion and inducement. Capital-intensive industries are transferred to technology- and knowledge-intensive industries, and the industrial chain is transformed from low-value to high-value. Emerging industrial sectors will continue to develop toward higher-quality pillar industries in terms of policies, resources, and markets.

In general, innovation-driven research mainly plays a comprehensive role in the transformation and upgrading of traditional industries through technological innovation, organizational innovation, and institutional innovation. Accordingly, the assumptions made are as follows:

H1a: when other conditions remain unchanged, innovation-driven is conducive to the transformation of traditional industries

H1b: when other conditions remain unchanged, innovation-driven is conducive to the upgrading of traditional industries

3.1.2. Micromechanism: Continuous Innovation and Transformation and Upgrading of Traditional Industries (Function of Factors)

(1) Entrepreneurship and the Transformation and Upgrading of Traditional Industries. Whether it is technological innovation or organizational innovation and institutional innovation, people ultimately need to undertake, and the people who carry out this recombination are called entrepreneurs. Entrepreneurship needs to rely on the market activities of entrepreneurial entities under the combined influence of innovation power and enterprise resource endowment through the process of exploring and identifying innovation opportunities and resource integration to achieve product, technological innovation, organizational innovation, institutional innovation, and ultimately lead to the transformation and upgrading of traditional industries. Entrepreneurship includes three levels: individual, organization, and society [13]. Neither individual entrepreneurship nor organizational entrepreneurship can affect the evolution of industrial boundaries and the economy [14]. In the context of the network, industrial entrepreneurship can search and integrate innovative resources across the industrial chain, integrate the best resources into high-end products, and rely on an extensive industrial network to lead to a comprehensive upgrade of the industry.

Microscopically, companies in a competitive market are faced with various uncertainties, and the success of R&D innovation is also full of various risks. Individuals or organizations or social entrepreneurs with a spirit of risk-taking and innovation can best take on this role. At the most basic level of the market, I can quickly understand the current market opportunities and demands. I can establish new enterprises or transform existing enterprises, rationally allocate the input resources, and realize the marketization from innovation to products. At the medium- and macrolevel, the entrepreneurial spirits of various regions converge into different regional industrial entrepreneurial spirits. Driven by regional entrepreneurship, traditional enterprises are upgraded to emerging industries, and newly established innovative enterprises can become pillar industries through continuous innovation. Gries and Naudé pointed out that the supply of intermediate goods and services, the increase of employment, and the improvement of productivity can realize the structural transformation of the traditional sector to the modern sector [15]. It can be seen that the spirit of entrepreneurship has extended to all levels of the "traditional industry-emerging industry-pillar industry" system. By promoting the reconstruction of the industrial chain, the innovation chain and the industrial chain are closely connected to realize the overall value-added of the industrial system. Therefore, we have reason to believe that entrepreneurship is conducive to the transformation and upgrading of traditional industries under the influence of external systems and other environments, and the relevant assumptions that are put forward are as follows:

H2a: entrepreneurship is conducive to the transformation of traditional industries when other conditions remain unchanged

H2b: entrepreneurship is conducive to the upgrading of traditional industries when other conditions remain unchanged

4. Network Capability and Upgrading of Traditional Industries

Continuous innovation requires high-quality network resources. With the help of information technology, the core competitiveness of an organization breaks the advantages of adjacent geographic space and turns to the construction of network relationships. Resource acquisition has expanded from enterprise networks to industrial networks. From a macroperspective, the industrial network between nodes in different provinces will be gradually established along with the inter-regional "industry, government, university, and research." This two-way network enables members to obtain innovative resources that are difficult to obtain by themselves, especially in the location of the central node is conducive to the control of key resources and enhances its own innovation ability, thus making it easier to succeed than peripheral nodes. In the same way, when the centrality of the inter-regional cooperation network in a province is stronger, its network capability will be greater, and there will be more opportunities to acquire irreplaceable knowledge, which is conducive to the construction of a wider external network relationship, thus greatly improving regional innovation efficiency [16]. At this stage, many high-tech industries in the country are in a "low-industrialization" situation because of insufficient R&D investment resources. To break through this predicament, resources must be sought from different networks. In particular, it is necessary to shift from a microenterprise network to a mesoscale industry network, which is conducive to breaking various geographical boundaries, promoting the exchange of resources and information in different subject networks, and sharing risks to ensure the breakthrough of resource thresholds, and ultimately solve the problem of emerging industries. Accordingly, the assumptions made are as follows:

H3: under the condition that other conditions remain unchanged, network capability is conducive to solving the problem of "low industrialization" of emerging industries and promoting industrial upgrading

5. Organizational Learning and Upgrading of Traditional Industries

Organizational innovation of organizational model and value chain reengineering needs to absorb cutting-edge knowledge through organizational learning, thereby increasing the probability of innovation success. Organizational learning can broaden the boundaries of innovative knowledge and optimize the learning mechanism. With the development of organizational learning at the individual level of the enterprise, the technical capabilities of the enterprise can be improved, however, to achieve the improvement of the overall industry level, it is necessary to transition from the individual organizational learning to the cluster learning at the entire industry level. When the regional industry develops to a certain scale, the successful experience in the past is easy to form path dependence, which leads to the failure of further transformation and upgrading of traditional industries, and it may also be difficult for emerging industries to develop sustainably to form pillar industries. The organizational learning of enterprises at the microlevel is conducive to break through organizational inertia, continuously innovate existing knowledge, and keep employees' knowledge innovated through continuous organizational learning. More organizational learning of enterprises is ultimately reflected in organizational learning at the regional level, which is conducive to overcoming industrial organization autism. In the "traditional industry-emerging industry-pillar industry" system, the static synergy balance is constantly broken. Each cycle of organizational learning is accompanied by the evolution of the industry, which is similar to a spiral upward development. The entire industry is continuously optimized and upgraded, becoming stronger and larger, breaking through the predicament of the pillar industry being large but not strong, and realizing the sustainable development of the industry. Accordingly, the assumptions made are as follows:

H4: under the condition that other conditions remain unchanged, organizational learning is conducive to solving the "big but not strong" dilemma of pillar industries and promoting industrial upgrading

Combined with the previous conceptual framework, theoretical analysis, and assumptions, the research framework model is shown in Figure 2.

5.1. Empirical Model. This paper mainly empirically tests the mechanism of continuous innovation-driven transformation and upgrading of traditional industries from macroaspects and microaspects. Combined with the theoretical analysis and assumptions above, the benchmark model designed is as follows:

$$\begin{aligned} CYZX_{it} = {} & \gamma_0 + \gamma_1 CXQD_{it} + \gamma_2 QYJS_{it} + \gamma_3 CSSP_{it} \\ & + \gamma_4 JRFZ_{it} + \gamma_5 ZFZC_{it} + \gamma_6 RLZB_{it} + \gamma_7 XXSP_{it} \\ & + \gamma_8 JCSC_{it} + \mu_i + v_t + \varepsilon_{it}, \end{aligned} \quad (1)$$

$$\begin{aligned} CYSJ_{it} = {} & \gamma_0 + \gamma_1 CXQD_{it} + \gamma_2 QYJS_{it} + \gamma_3 WRNL_{it} \\ & + \gamma_4 ZZXX_{it} + \gamma_5 CSSP_{it} + \gamma_6 JRFZ_{it} + \gamma_7 ZFZC_{it} \\ & + \gamma_8 RLZB_{it} + \gamma_9 XXSP_{it} + \gamma_{10} JCSC_{it} + \mu_i + v_t + \varepsilon_{it}. \end{aligned} \quad (2)$$

In the formula, *CYZX, CYSJ, CXQD, QYJS, WRNL, ZZXX, CSSP, JRFZ,* and *ZFZC* represent industrial transformation, industrial upgrading, innovation-driven, entrepreneurship, network capability, organizational learning, urbanization level, financial development, and government support, respectively. i is the province, t is the time, μ_i is the individual error, V_t is the time error, and ε_{it} is each channel item.

In the robustness test, a dynamic panel is set, and the model that is constructed by introducing the dependent variable lag term on the basis of the benchmark model is as follows:

$$\begin{aligned} CYZX_{it} = {} & \gamma_0 + \rho_1 CYZX_{it-1} + \gamma_1 CXQD_{it} + \gamma_2 QYJS_{it} \\ & + \gamma_3 CSSP_{it} + \gamma_4 JRFZ_{it} + \gamma_5 ZFZC_{it} + \gamma_6 RLZB_{it} \\ & + \gamma_7 XXSP_{it} + \gamma_8 JCSC_{it} + \mu_i + v_t + \varepsilon_{it}. \end{aligned} \tag{3}$$

$$\begin{aligned} CYSJ_{it} = {} & \gamma_0 + \rho_1 CYSJ_{it-1} + \gamma_1 CXQD_{it} + \gamma_2 QYJS_{it} \\ & + \gamma_3 \mathrm{WRNL}_{it} + \gamma_4 ZZXX_{it} + \gamma_5 CSSP_{it} \\ & + \gamma_6 JRFZ_{it} + \gamma_7 ZFZC_{it} + \gamma_8 RLZB_{it} + \gamma_9 XXSP_{it} \\ & + \gamma_{10} JCSC_{it} + \mu_i + v_t + \varepsilon_{it}. \end{aligned} \tag{4}$$

$CYZX_{it-1}$ and $CYSJ_{it-1}$ in the above two dynamic panel models represent the first-phase lag terms of traditional industry transformation and traditional industry upgrading, respectively, ρ_1 represents the corresponding coefficient, and the interpretation of other symbols is consistent with the previous benchmark model. Among them, formulas 1 and 3 test the transformation of traditional industries driven by continuous innovation, and formulas 2 and 4 test the upgrading of traditional industries driven by continuous innovation.

5.2. Variable Setting

5.2.1. Explained Variables. The transformation and upgrading of traditional industries are divided into two stages. Transformation (CYZX) draws on the ideas of Tu and Yan [6], and it uses the ratio of the output value of emerging industries to traditional industries to measure; the upgrade (CYSJ) draws on the idea of Li [17], and the measurement model is

$$CYSJ = \sum_{i=1}^{3} \sqrt{L_i} \times K_i \mathrm{i} = 1,\ 2,\ 3. \tag{5}$$

In formula 5, CYSL represents industrial upgrading, 1 is the traditional industry, 2 is the emerging industry, 3 is the pillar industry, K is the proportion of the output value of each industry and regional GDP, and L is the labour productivity of each industry, expressed as the ratio of output value of each industry to the number of employees in that industry.

5.2.2. Main Explanatory Variables. ① Innovation-driven research (CXQD) mainly draws on the practice of Mao and Jiang[18], uses innovation input, output, and environment as indicators, and then uses the entropy weight method to obtain a comprehensive score to measure. ② Entrepreneurship (QYJS) draws on the practice of Xu [19] and adjusts it appropriately, using (number of private enterprises + number of self-employed)/(number of private employees + number of self-employed workers) as a substitute variable for entrepreneurship. ③ Network capability (WRNL). Wang [20] proposed the following gravitational model of economic connection strength, which is as follows:

$$F_{ij} = K_{ij} \frac{\sqrt{Pi * Gi} * \sqrt{Pj * Gj}}{D_{ij}^2}. \tag{6}$$

In formula (6), i, j are cities, P is the population index, G is GDP, D is the distance between two cities, and K is a constant, which is usually $K = (Gi + Gj)/2$. In the follow-up research, some scholars have revised this gravity model. For example, Zou [21] introduced "urban built-up area" when studying the economic connection strength of cities in the Yangtze River Economic Belt. Patents can better reflect regional network capabilities than area, and the new gravity model of economic ties strength (where S is the number of patent applications in each province and D_{ij} is the shortest traffic distance between provincial capital i and provincial capital j) becomes

$$F_{ij} = K_{ij} \frac{\sqrt[3]{S_i P_i G_i} * \sqrt[3]{S_j P_j G_j}}{D_{ij}^2}. \tag{7}$$

Then, using the model of (7) and borrowing the practice of Guo et al., [22] the betweenness centrality is calculated to measure the network capability. The betweenness centrality reflects the degree to which a node i of the network is located at the center of other nodes, i.e., the ratio of the number of all shortest paths, including node i, between two points to the total number of shortest paths, where the shortest path refers to the path of the least intermediate nodes through which two different nodes are connected. This shortest path may not be unique, and the formula is shown in

$$C_e(i) = \frac{\sum_{j<k} f_{jk}(n_i)/f_{jk}}{(f-1)(f-2)}. \tag{8}$$

$C_e(i)$ represents betweenness centrality, $f_{jk}(n_i)$ represents the number of shortest paths between point j and point k through point i, i.e., the number of all shortest paths passing through node i, f_{jk}represents the number of shortest paths between point j and point k, and f represents the nodes in the regional network (province) total. It should be emphasized that, after calculating the economic strength of each province using the gravity model, to prevent the influence of other factors on the overall correlation, the calculated economic linkage strength is optimized with formula 9 model.

$$I_a(F_i) = \begin{cases} 1 & F_i \geq D \\ 0, & F_i < D \end{cases} \tag{9}$$

In formula 9, it $F_i$represents the economic connection strength of a province in the region, and D represents the "threshold value," which is obtained by sorting the economic connection strength of each province in each column (row) from small to large, and then drawing all data nodes. Figure and calculate the corresponding slope of each node, and then select the node with the flattest straight line as the "threshold" D. If the slope is greater than this, it is 1, otherwise it is 0.

④ Organizational learning (ZZXX) is a process variable, which is dynamic and difficult to describe in terms of inventory. Dodgson believes that organizational learning is the construction, supplement, and organization of knowledge and habits in business activities and culture, and the use of team skills to better improve the efficiency of the organization [23]. Hence, this paper believes that the innovation of regional samples' efficiency can reflect organizational learning to a certain extent. Enterprises, universities, and scientific research institutions in the innovation network structure are used as the main body to construct an input-output model and calculate efficiency to measure regional organizational learning variables. Each enterprise entity is as follows: 5 input indicators (number of R&D personnel, full-time equivalent of R&D personnel, internal expenditure of R&D funds, R&D institutions, and number of R&D projects), 3 output indicators (number of new product development projects, new product sales revenue, and number of patent applications), main body of universities: 4 input indicators (number of R&D personnel, full-time equivalent of R&D personnel, internal expenditure of R&D funds, and number of R&D projects), and 3 output indicators (number of published scientific papers, published scientific works, and patent applications). The main body of scientific research institutions is as follows: 4 input indicators (number of R&D personnel, full-time equivalent of R&D personnel, internal expenditure of R&D funds, and number of R&D projects) and 3 output indicators (number of published scientific papers, published scientific and technological works, and number of patent applications). Firstly, the Mydea software was used to calculate the superefficiency of each province in each year, and then, the entropy weight method was used to measure the comprehensive index of the superefficiency of enterprises, universities, and scientific research institutions to measure the organizational learning ability.

5.2.3. Control Variables

① *Urbanization Level (CSSP).* Drawing on the practice of Yuan [8], this paper uses the proportion of the urban employment population in each province to the total population to measure the urbanization level indicator.

② *Financial Development (JRFZ).* Drawing on relevant literature, the financial development is measured by the loan balance of financial institutions at the end of the year, and the natural logarithm is taken for calculation.

③ *Government Support (ZFZC).* This paper draws on Yuan [8] to measure government support using the proportion of general public fiscal expenditure in GDP.

④ *Human Capital (RLZB).* This paper draws on the practice of Yuan [8] and uses the number of students in ordinary institutions of higher learning per 10,000 people to measure the human capital of each province.

⑤ *Information Level (XXSP).* In this paper, the total amount of post and telecommunications business is used to measure the level of informatization, which can basically reflect the overall informatization level of a region.

⑥ *Infrastructure (JCSC).* Drawing on relevant literature, this paper chooses the per capita road mileage to measure the local infrastructure.

5.3. Samples and Data Sources. The samples in this paper are all 30 provinces and cities in mainland China (except Tibet because of incomplete data), and the time span is the corresponding statistical data from 2008 to 2019. Among them, the data of traditional industries are mainly from the "Industrial Statistical Yearbook," the data of emerging industries are mainly from the "China Hightech Statistical Yearbook," and some data about entrepreneurship related to private enterprises are from the "China Private Economic Yearbook." The organizational learning mainly comes from the "China Science and Technology Statistical Yearbook," and other data are all from the "National Data" website and the statistical yearbooks of various provinces in China. Some missing values use completion by interpolation or mean of upper and lower years. Taking into full account the impact of inflation and price factors, all the monetary indicators of value are dealt with using the CPI deflator with 2008 as the base period.

Traditional industry classification mainly draws on the practice of Yu and Liu [24] and makes appropriate modifications, and it excludes extractive industry and electric power. The production and supply industries of gas and water only retain 21 industries in the manufacturing industry. Emerging industries learn from the practice of Yu and Liu [24] and others and replace emerging industries with hightech industries. The existing hightech industries are pharmaceutical manufacturing, aviation, spacecraft, equipment manufacturing, electronics and communication equipment manufacturing, computer, and office. Equipment manufacturing, medical equipment, instrumentation manufacturing, and information chemicals manufacturing have a total of 6 industries. It is difficult to determine the pillar industry, and there is no similar or related pillar industry data. The logic of this paper to determine the pillar industry at the provincial level is as follows: assuming that the entire industry can be divided into two categories, namely traditional industries and emerging industries, perform factor analysis, etc., to rank the traditional industries and emerging industries in the province, and get the top

5 industries as the province's pillar industries. The rest are classified as traditional industries or emerging industries.

5.4. Descriptive Statistical Analysis and Correlation Analysis. It can be seen from Table 1 that the mean, standard deviation, maximum values, and minimum values of each variable have no special abnormal values, which can be used for further research. Table 2 is the correlation analysis of traditional industry transformation (CYZX), industry upgrading (CYSJ), innovation drive (CXQD), entrepreneurship (QYJS), network capability (WRNL), and organizational learning (ZZXX). The correlation between these variables is not high, indicating that there is no serious multicollinearity between these variables. In particular, the correlation between traditional industry transformation (CYZX) and industrial upgrading (CYSJ) is at a low level of 0.002, indicating that the two dimensions of industrial transformation and industrial upgrading are well-differentiated. The basic conditions are created without too much consideration of the interaction between the two. The coefficients of innovation drive, entrepreneurship, network capability, and industrial transformation are 0.462, 0.369, and 0.162, and they are all significant at the 1% level. The coefficients of innovation drive, entrepreneurship, network capability, and industrial upgrading are 0.168, 0.097, 0.311, and 0.142 and were all significant at the level below 10%, and H1a, H1b, H2a, H2b, H3, and H4 were all tested initially.

6. Empirical Analysis

Based on the model constructed above, this part uses the stata14 software to test through OLS. Static panel and dynamic panel are used in robust testing. There are three ideas. Firstly, test the macro mechanism of continuous innovation-driven transformation and upgrading of traditional industries (see (1), (4) in Table 3 and (9), (12) in Table 4). The second is to examine the micromechanism of the transformation and upgrading of traditional industries driven by continuous innovation (see (2), (5), (6), and (7) in Table 3). Columns are the same as (10), (13), (14), and (15) in Table 4. The third is to comprehensively consider all factors affecting the transformation and upgrading of traditional industries (see (3), (8) in Tables 3 and 4 and (11), (16) columns).

6.1. Ordinary Least Squares (OLS). The examination of the macro mechanism is as follows: in the columns (1) and (4) of Table 3, column (1) shows that the coefficient of innovation driving (CXQD) and industrial transformation (CYZX) is 2.273, which has passed the 1% level significance test, and H1a is preliminarily established. Column (2) shows that the driving coefficient (CXQD) and industrial upgrading coefficient (CYXJ) are -4.565, and it did not pass the significance test. H1b needs further testing.

The examination of microscopic mechanisms is as follows: columns (2), (5), (6), and (7) in Table 3 indicate that entrepreneurship (QYJS) and industrial transformation (CYZX), industrial upgrading (CYSJ), network capability (WRNL), organizational learning (ZZXX), and industrial upgrading (CYSJ) are significant at the 1% level, and H2a, H2b, H3, and H4 are initially established.

The comprehensive factor test is as follows: the effects of industrial transformation and upgrading are listed in columns (3) and (8) in Table 3. Except for the coefficient and significance, there is a slight difference, however, the direction and nature have not changed, indicating that the influence of each factor has a certain stability, namely H1a, H2a, H2b, H3, and H4, which were initially tested, while H1b was not initially tested. These conclusions need to be further tested with panel data.

6.2. Static Panel Regression Analysis. The above OLS is a statistical analysis of all sample data in the form of cross-sectional data. It is difficult to overcome the possible autocorrelation and heteroscedasticity of the data. The conclusions obtained may be inaccurate. Whether the conclusions are relevant and reliable, The sample data needs to be set to panel data for further inspection. Since the sample $N = 30$, $T = 11$, $N > T$, the sample panel constructed in this paper is a short panel, and its conclusion is relatively reliable than the cross-sectional data. Another advantage of panel data is that it can dynamically model the behavior of individuals. When analyzing short-panel data, two kinds of analysis, namely fixed effect and random effect, can be carried out. The model to be used needs to be judged by the Hausman test. After the Hausman test, the p-values of (9)-(16) in Table 4 are as follows: 0.1484, 0.0008, 0.1531, 0.4108, 0.0787, 0.2582, 0.016, and 0.0715. Hence, columns (10) and (15) use a fixed model. The other columns use random models, and the statistical regression results are shown in Table 4.

The examination of the macromechanism is as follows: the coefficient of innovation drive (CXQD) and industrial transformation (CYZX) in (9) in Table 4 is 2.089, which has passed the 1% level significance test, indicating that with the increase of innovation drive, the industrial transformation will also increase, and H1a has been tested. (12) column shows that the coefficient of innovation driving (CXQD) and industrial upgrading (CYXJ) is 2.073. The direction is in line with the hypothesis, however, it has not passed the significance test, and H1b has not been tested.

The examination of microscopic mechanisms is as follows: from the columns (10), (13), (14), and (15) in Table 4, it can be seen that these columns indicate that entrepreneurship (QYJS), industrial transformation (CYZX), and industrial upgrading (CYSJ) are 0.443 and 0.258, respectively. The coefficients of ability (WRNL), organizational learning (ZZXX), and industrial upgrading (CYSJ) are 7.432, 0.527, and 5.104, respectively, and all have passed the 1% level significance test, indicating that every 1% increase in entrepreneurship will lead to industrial transformation, and industrial upgrading increased by 44.3% and 25.8%, respectively. With the improvement of network capabilities and organizational learning, industrial upgrading will increase. Hence, H2a, H2b, H3, and H4 have been verified.

The comprehensive factor test is as follows: column (11) in Table 4 shows that the innovation-driven and entrepreneurial and traditional industry transformation coefficients

Table 1: Descriptive statistical analysis table of variables.

Variable type	Variable name	Sample value	Mean	Standard deviation	Minimum	Maximum value
Explained variable	Industrial transformation (CYZX)	330	0.168	0.294	0.001	2.981
	Industrial upgrading (CYSJ)	330	6.894	4.255	0.324	24.208
Explanatory variables	Innovation driven (CXQD)	330	0.192	0.160	0.023	0.717
	Entrepreneurship (QYJS)	330	0.599	0.158	0.239	1.084
	Network capability (WRNL)	330	1.208	1.976	0.006	10.352
	Organizational learning (ZZXX)	330	0.230	0.139	0.029	0.993
Control variable	Urbanization level (CSSP)	330	12.373	5.783	5.603	38.036
	Financial development (JRFZ)	330	25455.140	23015.300	1033.900	145169.400
	Government support (ZFZC)	330	23.603	9.947	8.744	62.686
	Human capital (RLZB)	330	81.765	48.493	4.220	214.080
	Information level (XXSP)	330	5.069	2.833	1.435	15.646
	Infrastructure (JCSC)	330	36.294	22.113	5.156	136.153

Table 2: Correlation coefficient table of variables.

	CYZX	CYSJ	CXQD	QYJS	WRNL	ZZXX
CYZX	1					
CYSJ	0.002	1				
CXQD	0.462***	0.168***	1			
QYJS	0.369***	0.097*	0.636***	1		
WRNL	0.162***	0.311***	0.598***	0.358***	1	
ZZXX	-0.041***	0.142***	-0.009	0.127**	0.089	1

Note. $^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.1$.

Table 3: OLS analysis table.

	Industrial transformation				Industrial upgrading			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Innovation driven (CXQD)	2.273*** (12.02)		2.185*** (11.29)	−4.565 (−1.38)				−11.804*** (−3.23)
Entrepreneurship (QYJS)		0.602*** (3.98)	0.255* (1.94)		6.412*** (2.87)			5.266** (2.25)
Network capability (WRNL)						0.378*** (2.82)		0.433*** (2.73)
Organizational learning (ZZXX)							4.890*** (3.00)	3.752** (2.31)
Urbanization level (CSSP)	−0.014*** (−3.15)	0.012*** (2.86)	−0.016*** (−3.53)	0.049 _ (0.65)	−0.101 (−1.57)	−0.009 (−0.15)	−0.023 (−0.41)	0.098** (1.17)
Financial development (JRFZ)	−8.42e*** (−7.81)	−4.78e*** (−3.94)	−8.74e*** (−3.53)	8.68e − 06 _ (0.46)	−0.0001 (−0.78)	−0.00001 (−0.76)	4.18e (0.00)	7.41e (0.00)
Government support (ZFZC)	−0.001** (−0.57)	−0.005* (−1.72)	−0.002 (0.76)	0.069 _ (1.65)	0.066 (1.59)	0.090** (2.16)	0.042 (0.98)	0.047 (1.09)
Human capital (RLZB)	−0.001*** (−2.29)	0.001** (2.19)	−0.0009 (−1.62)	0.040*** _ (4.26)	0.042*** (4.63)	0.034*** (3.87)	0.036*** (4.06)	0.049*** (5.21)
Information level (XXSP)	−0.006 (1.36)	0.016*** (3.04)	0.006 (1.37)	− 0.183** (−2.22)	−0.215*** (−2.7)	−0.196** (−2.46)	−0.153** (−1.88)	−0.106 (−1.30)
Infrastructure (JCSC)	−0.001 (−0.84)	−0.000 (−0.31)	−0.0002 (−0.18)	− 0.035** (−2.13)	−0.016 (−0.95)	−0.032* (−1.94)	−0.021 (−1.29)	−0.015 (−0.86)
_Cons	0.243** (2.52)	−0.29** (−2.13)	0.102 (0.84)	4.266** _ (2.53)	1.367 (0.68)	4.118** (2.49)	3.714** (2.22)	−0.612 (−0.30)
N	330	330	330	3 30	330	330	330	330
R^2	0.4399	0.227	0.446	0.1823 _	0.1980	0.1973	0.1825	0.2468

Note. (1)$^{***}p < 0.01$, $^{**}p < 0.05$, and $^{*}p < 0.1$. (2) t values are in parentheses.

Table 4: Static analysis table.

	Industrial transformation				Industrial upgrading			
	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Innovation driven (CXQD)	2.089*** (10.40)		2.003*** (9.81)	2.073 (0.58)				−2.819 (−0.72)
Entrepreneurship (QYJS)		0.443*** (3.15)	0.258** (2.03)		7.432*** (3.49)			5.548** (2.53)
Network capability (WRNL)						0.527*** (4.06)		0.422*** (2.75)
Organizational learning (ZZXX)							5.104*** (3.09)	3.501** (2.10)
Urbanization level (CSSP)	−0.009** (−2.14)	0.016*** (4.16)	−0.01** (−2.53)	− 0.037 (−0.49)	−0.100* (−1.66)	0.014 (0.27)	−0.014 (−0.26)	−0.019 (−0.23)
Financial development (JRFZ)	−8.07e−06*** (−6.85)	−2.60e−06** (−2.03)	−8.48e−06*** (−7.08)	− 0.000 (−1.38)	−0.00003** (−2.13)	−0.00005*** (−2.66)	−0.000 (−1.16)	−0.00005** (−2.48)
Government support (ZFZC)	−0.001 (−0.40)	−0.0007 (−0.21)	−0.00 (−0.67)	0.060 (1.34) _	0.037 (0.86)	0.057 (1.31)	0.042 (0.89)	0.017 (0.36)
Human capital (RLZB)	−0.001 (−1.57)	0.002*** (3.22)	−0.00 (−0.92)	0.032*** _ (3.55)	0.041*** (4.87)	0.032*** (3.88)	0.033*** (4.03)	0.039*** (4.28)
Information level (XXSP)	0.012* (1.81)	0.038*** (3.35)	0.014** (1.98)	− 0.498*** (−3.43)	−0.366*** (−3.03)	−0.371*** (−2.70)	-0.62^{2***} (−3.64)	−0.419** (−2.37)
Infrastructure (JCSC)	−0.001 (−0.79)	−0.0004 (−0.32)	−0.000 (−0.07)	− 0.037** (−2.39)	−0.016 (−0.99)	−0.034** (−2.24)	−0.030* (−1.91)	−0.015 (−0.89)
_Cons	0.141 (1.37)	−0.543*** (−4.19)	−0.004 (−0.03)	7.534*** _ (4.00)	2.874 (1.46)	6.548*** (3.84)	6.985*** (4.15)	3.508 (1.65)
N	330	330	330	3 30	330	330	330	330
R^2	0.3990	0.2655	0.4073	0.2072 _	0.2336	0.2469	0.2307	0.1840

Note. (1)*** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$. (2) z values are in parentheses.

are 2.003 and 0.258, respectively, and they passed the 1% and 5% significance tests, respectively. Column (16) shows that in addition to innovation-driven, the spirit of coefficient, network ability, organizational learning, and industrial upgrading are 5.548, 0.422, and 3.501, respectively, and they have passed the 5%, 1%, and 5% significance tests, respectively. The conclusions are still the same, indicating that the influence of each factor has a certain stability.

In summary, H1a, H2a, H2b, H3, and H4 were verified, while H1b was not verified. Innovation-driven research has a significant positive effect on industrial transformation but failed to play a positive role in promoting industrial upgrading. The possible reason is that traditional industries and emerging industries in different economic regions have not been well-coordinated in development, and emerging technologies and traditional industries have not been well-coordinated. In the process of innovation, technology has a competitive relationship with the allocation of scarce resources. Although emerging technologies have high technical content, they have high costs in the short term and are difficult to bring about an increase in the upgrading of emerging industries. Traditional technologies are relatively mature and have a stabilizing effect on traditional industries, however, they lack potential. It is difficult for the sustainable development momentum to bring qualitative improvement to the upgrading of traditional industries.

At the same time, it is also found in the control variables that the level of informatization (XXSP) has a significant positive effect on the transformation of traditional industries but has a significant negative effect on industrial upgrading. Human capital (RLZB) generally has a good effect on the transformation and upgrading of traditional industries.

7. Robustness Test: Based on Dynamic Panel Analysis

The previous OLS and static panel conclusions are completely consistent, however, there may be endogeneity problems, such as omitted variable bias, variable measurement error, and two-way causality, among the variables in the model. To test the endogeneity problem, this part uses SYS-GMM for statistical estimation. Compared with the mixed OLS and fixed effects methods, SYS-GMM can correct for unobserved measurement error, individual heterogeneity, omitted variables, and potential endogeneity. It is also more accurate and efficient than DIF-GMM.

It can be seen from Table 5 that in the Arellano Bond test, the statistical values of AR(1) for traditional industrial transformation and industrial upgrading are 0.024 and 0.000, respectively, while the statistical values for AR(2) are 0.161 and 0.761, respectively. It indicates that the first-order difference in the model has first-order autocorrelation in the error term, but there is no second-order autocorrelation.

Table 5: Dynamic analysis table.

	SYS-GMM	
	Industrial transformation	Industrial upgrading
L1.	0.426*** (129.85	0.156*** (6.66)
x1	1.27*** (23.63)	-5.660** (-2.14)
x2	0.122** (2.07)	6.721*** (2.61)
x3		0.649*** (5.26)
x4		4.428*** (2.70)
Control variable	Control	Control
-Cons	0.445*** (7.07)	−0.467 (−0.10)
Hansen	0.998	0.594
AR(1)	0.024	0.000
AR(2)	0.161	0.761
N	240	300

Note. (1)*,**, and *** represent significance at the 10%, 5%, and 1% significance levels, respectively. (2) The z value is in brackets.

Hence, the model design is valid, and the p-values of the Hansen statistic are 0.998 and 0.594 (both are greater than 0.1). The null hypothesis cannot be rejected, and hence, all tools can verify that variables are valid.

From the perspective of the lag term of the explained variable, the coefficients of CYZX $_{\text{it-1}}$ and CYSJ $_{\text{it-1}}$ are 0.426 and 0.156, respectively, which have passed the significance test of less than 1%, indicating that both traditional industrial transformation and industrial upgrading have intertemporal correlations. The industrial development foundation of the previous period has a positive effect on the current industrial development, reflecting the "inertia" characteristics of the high-quality development of the industry to a certain extent.

From the perspective of the main explanatory variables, the coefficients of innovation drive (CXQD) on traditional industry transformation (CYZX), entrepreneurship (QYJS), network capability (WRNL), and organizational learning (ZZXX) on traditional industry upgrading (CYXJ) are all positive. Through the significance test at different levels, innovation-driven (CXQD) research to traditional industry upgrading (CYXJ) is inconsistent with the hypothesis.

Combining OLS, static panel, and dynamic panel, the test results of the three are completely consistent, and it can be concluded that H1a, H2a, H2b, H3, and H4 have been verified, however, H1b has not been verified. Hence, the empirical results in this paper are reasonably robust.

8. Research Conclusions and Implications

8.1. Research Conclusions. This paper constructs a staged model for the transformation and upgrading of traditional industries and a model of continuous innovation driving mechanism. Based on the panel data of China's provinces from 2008 to 2019, it uses OLS, HAUSMAN, SYS-GMM, and other methods to analyze the continuous transformation and upgrading of traditional industries. For the macro- and micromechanisms of innovation-driven research, the conclusions are as follows: (1) in the macroaction mechanism, innovation-driven research generally has a significant positive impact on the transformation of traditional industries through functional activities, such as technological innovation, organizational innovation, and institutional innovation, however, it fails to have a significant positive impact. (2) In the microaction mechanism, entrepreneurship, network ability, and organizational learning have a significant positive impact on the transformation and upgrading of traditional industries.

8.2. Possible Theoretical Contributions. The main theoretical contributions are as follows: (1) based on the innovation-driven theory and the continuous innovation theory, the concept of continuous innovation-driven is proposed for the first time, and microinnovation and macroinnovation are incorporated into a unified framework, which is the deepening of the innovation theory in the context of the new normal. (2) Defining the concept of transformation and upgrading based on the perspectives of traditional industries, emerging industries, and pillar industries, transforming from traditional industries to emerging industries, and upgrading from traditional industries or emerging industries to pillar industries will help solve the inconsistency of existing research on the transformation and upgrading of traditional industries. (3) Use factor analysis to separate pillar industries from traditional industries and emerging industries and put forward quantitative ideas for research in the same category.

8.3. Management Implications. First, strengthen the top-level design of innovation-driven policies. We should further strengthen the top-level design of sci-tech innovation policy, plan well the key and priority fields, bring the sci-tech resources and innovation elements into the public policy, construct the diversified and efficient sci-tech fund investment system, and build the R & D investment system. The proportion of funding to GDP should be increased year by year to ensure that basic research projects are adequately funded and subsidized. At the same time, simplify the registration process of small and medium-sized enterprises and actively create an atmosphere of independent innovation of small and medium-sized enterprises.

Secondly, cultivate the fertile soil of entrepreneurship. The state must make efforts to build a business development environment suitable for private enterprises to innovate and start their own businesses, cultivate the fertile soil for the cultivation of entrepreneurship, encourage the initiative of private enterprises and individual businessmen to start their own businesses, to loosen all kinds of market main body directly into excessive regulation, reduce the local administrative department of entrepreneurs and entrepreneurship improper intervention, the implementation of the "largest," simplifying the project establishment, examination and approval, registration, and other procedures, mixed economy as the main breakthrough, for state-owned enterprises to deepen reform, promote private enterprises and state-owned enterprise spirit in the process of transformation and upgrading of traditional industries in our country.

Thirdly, build the formal and informal network relationship and improve the capacity of regional network. Local governments in regions with a certain innovation basis pay attention to provide comprehensive cooperation support for enterprises and actively and effectively promote the construction of regional innovation networks. In some relatively backward regions with weak innovation base, the government can actively construct various formal and informal networks across regions by reducing transaction costs and breaking the segmentation of markets and administrative regions. To maintain the free flow of people, capital, information, commerce, and logistics in the network, provide the necessary network resources for the emerging industries to tide over the difficult initial stage, exert the role of resource leverage, and finally overcome the tendency of low-industrialization in the industrial development, make the industrial system obtain a steady flow of resources to have a reliable guarantee.

Fourth, promote the learning ability of regional organizations. Through the use of learning to refine and deepen the existing knowledge, promote the improvement of the stock and quality of emerging industries, through the development of learning to explore, try, risk, and innovation to break the status quo, create new knowledge, from high value-added industries and industrial division of labor in the high-end elements of subcentral regions to achieve incremental industrial breakthrough. Efforts should be made to expand the level of opening to the outside world, introduce external competition factors, stimulate the enthusiasm of regional organizations to learn, force the deepening of economic structural adjustment, through continuous learning and continuous strengthening, expand the traditional industries or emerging industries, and finally close to the pillar industries to achieve industrial transformation [25].

Data Availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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