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Green Innovation's Promoting Impact on the Fusion of Industry and Talent: The Case of Pharmaceutical Industry in the Yangtze River Economic Belt of China

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Abstract: This study aims to explore the promoting impact of green innovation on the fusion of industry and talent (FIT). The primary objectives of the study also include showing how FIT affects the Yangtze River Economic Belt of China and evaluating the development status of three subsystems: the pharmaceutical industry, talent support, and green innovation. In this study, an index system comprising 28 indicators is established to characterize the three subsystems, based on which a comprehensive evaluation model is used to assess the development of each subsystem. A fusion model is used to explore the current status of FIT and the role that green innovation plays in this, based on panel data obtained for 11 provinces and cities in the Yangtze River Economic Belt from 2010 to 2019. The results suggest that: (1) the three subsystems in the Belt have all maintained growth, though the development score for the pharmaceutical industry fluctuated greatly and has been somewhat unstable, while growth trends for talent support and green innovation have been stable; (2) the extent of FIT is low, with nearly half of the provinces and cities lacking organization, with a typical spatial pattern of higher levels in the downstream region and lower levels in the upstream region. The downstream region has obvious advantages in the degree of FIT, while the upstream region has a more optimistic growth trend; and (3) green innovation stimulated the development of FIT in the Belt, with a "strong and stronger" trend depending on the foundation of FIT. To promote FIT, the government should (1) focus on enhancing the development and efficiency of green innovation to help promote FIT; (2) promote the stable and sustainable growth of the pharmaceutical industry as well as talent's support to consolidate the foundation of fusion; and (3) implement regional coordinated development and interaction policies to narrow the regional gap.

Keywords: green innovation; pharmaceutical industry; talent support; fusion of industry and talent

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1. Introduction

In recent years, a green development approach with the theme of "economic growth, resource conservation and environmental friendliness" has been given a great deal of attention. With increasing pressure on industry resulting from the need for ecological and environmental protection and sustainable development, green innovation development has gradually become a central issue of concern [1]. According to the *Health Care Without Harm Report 2021*, with the rapid growth of medical treatment globally, the energy consumption generated by medical services, pharmaceutical R&D, and production has increased substantially, with industry carbon emissions now accounting for 4.4% of all carbon emissions [2]. The impact of pharmaceutical manufacturing on ecological degradation and global warming cannot be ignored. In the process of economic development, green innovation resources have significant advantages over other innovation resources. Thus, strengthening the development of green innovation resources and capitalizing fully on green innovation resources are key to promoting industrial transformation and economic development. Globally, highly concentrated industrial clusters, and the employment of highly skilled people, are important features of the development of the pharmaceutical industry. The need to ensure that talent is available to meet the needs of industry reflects contemporary developments and the technical advancement of the industry. In recent years, China has sought to accelerate the matching of available talent to the needs of the pharmaceutical industry. However, the current Chinese pharmaceutical industry is large but not strong, and there is an urgent need for talent resources that match modern industrial developments. A lack of understanding of the green agenda and insufficient independent innovation ability have become major constraints [3]. With predictions of "peak" carbon, the need for carbon neutrality, and the requirement to pursue sustainable development goals, green innovation is not only important for the high-quality growth of the pharmaceutical industry but also represents an impetus to develop high-level talent [4]. Green innovation can enable the saving of resources and protection of the environment based on the characteristics of novelty and value [5]. The promotion of the further coordination and integration of industry and talent through green innovation is an important issue in contemporary industrial economic development. It is important to determine how green innovation can affect the integration of industry and talent, in order to optimize the allocation of industrial resources, enhance the level of scientific and technological innovation, and promote green development.

The economic belt along rivers has long been regarded as a strategic priority for economic development globally. As the largest inland river economic belt in the world, China's Yangtze River Economic Belt (hereafter referred to as the Belt) spans three regions in eastern, central, and western China. It is the largest developable economic belt with the widest influence in China. As an important pharmaceutical production base in China, the Belt shows some distinct advantages in the pharmaceutical industry, which accounted for 40% of the country's GDP in 2020. In the context of global scientific and technological revolution and industrial transformation, as well as the influence from such domestic policy changes as volume-based procurement and the dynamic adjustment made to the national medical insurance catalog, the macro-environment of China's pharmaceutical industry has frequently changed in the direction of development, with green innovation accepted as an important theme of the pharmaceutical industry. Although the Belt stands out in the wave of green innovation due to its superior innovation resources and greater market inclusiveness [6], the green innovation efficiency of the Belt is low, and there is a significant spatial variation in industrial green innovation between different regions [7]. To address this issue, this study is aimed at analyzing the logic of FIT and the mechanism of influence exerted by green innovation on FIT, evaluating the comprehensive development score of the pharmaceutical industry, talent support, and green innovation through a comprehensive development model and exploring the current state of FIT and the promoting effect of green innovation on FIT in the Belt according to the fusion model. This is expected to enrich the research results on FIT and the impact of green innovation on FIT, thus providing a reference for the further improvement of FIT in the Belt.

This paper marks the first attempt made to explore the impact of green innovation on the FIT of the pharmaceutical manufacturing industry. On the one hand, it can enrich the research on the FIT and the impact of green innovation. On the other hand, the empirical results of this paper can be used to explain whether green innovation can have a promoting effect on the FIT of the pharmaceutical manufacturing industry, thus assisting policymakers in further improving the FIT in China's Yangtze River Economic Belt.

The remainder of the paper is organized as follows. Section 2 presents a complete literature review of green-innovation-related studies, the theoretical framework of FIT, and the impact of green innovation on FIT. Section 3 elaborates on the index system, methodology, and data. In Section 4, the results are shown, and a discussion is conducted. Section 5 concludes the study with policy implications, the limitations of this study, and the next step of research.

2. Literature Review

2.1. Green-Innovation-Related Studies

Since the 1980s, when Brundtland put forward a sustainable development model in his report *Our Common Future*, there has been close attention paid by academics to the issue of economic development and resource and environmental constraints [8]. Since the beginning of the 21st century, such economists as Cooke have attempted to combine green development with innovation systems, with the relevant studies conducted from the perspectives of resource conservation and environmental protection [9,10]. Various issues of performance measurement [11], efficiency measurement [12,13], impact mechanism [14], and policy research on green innovation have become the main areas of research for domestic and international scholars.

As for industrial sustainable development, there is a growing concern about the negative impact of industrial activities on the environment and an increasing commitment made to developing environmentally friendly or less harmful products to reduce environmental stress and achieve sustainability. As indicated by Qu and Liu, green innovation plays a crucial role in this process and is effectively addressing the growing environmental issues and requirements for sustainable industrial development, as green production processes can be adopted by firms to develop the new green products that differentiate themselves from the competitors [15]. According to Jiang et al., the increase in energy consumption can motivate firms to perform green innovation activities, which suggests a positive and bilateral relationship between green innovation and economic sustainability [16]. As revealed by Li et al., green innovation exerted not only a significant influence on corporate sustainability in energy-intensive industry through the structural equation model but also a positive impact on performance both financially and socially [17]. In the view of Fei and Li, the adoption of green innovation technologies in the manufacturing industry is conducive to enhancing sustainability under market mechanisms [18]. Notably, it was discovered that green entrepreneurship plays an important role in the process of increasing green innovation level to enhance sustainability, which allows firms to build awareness and capacity for green innovation directly or indirectly [19]. Besides, green innovation exerts a reverse promotion effect on green entrepreneurship [20]. Therefore, the leading strategic role of green entrepreneurs is to encourage firms to develop the organizational dynamics that not only empower them to produce as many innovative green products as possible but also promote the development of their green innovation level for the sustainable development of individual firms in the industry [21].

Regarding the performance in industrial development, Bülent and Çankaya conducted regression tests on the data collected from 53 companies in the automotive, chemical, and electronics manufacturing sectors in Turkey, demonstrating that green manufacturing applications had a significant positive impact on environmental and social performance [11]. Relying on technology and innovation, OECD countries and emerging economies explored new ways to accelerate the transition to green development [22]. By analyzing the data from 2005 to 2007 for 110 manufacturing sectors in eight countries—China, Germany, France, Italy, Japan, Korea, the UK, and the US—Sam Fankhauser et al. discovered that green innovation can enhance the competitive advantage of manufacturing among countries [23], but at the same time the path of green technology innovation affected the transformation, and the upgrading of manufacturing varies with the level of environmental regulation. Besides, it was found in the study of Zhang to exert a dampening effect when the level of environmental regulation is low, stimulate the industry to develop rapidly when the level is medium, and move the industry into a low and stable period when the level is high [24,25].

With regard to the impact of talent concentration, there has been a consensus reached within the industry and in enterprise management on the existence of a talent war and the scarcity of talent as a resource [26]. In spite of this, there are fewer scholars who have directly investigated the impact of green innovation on talent concentration, which can be described from two perspectives. One is the impact of green environmental development on talent concentration and mobility. When economic development reaches a certain level, income level rises, people's demand for environmental comfort grows, and the possibility of talent migration or loss increases [27]. Jiang and Li analyzed the panel data collected from 211 Chinese cities to discover the impact of improving the habitat environment on urban innovation, which leads to the results showing that the concentration of high-quality talent can be promoted by the improvement of the living environment and innovation capacity [28]. The other is the effect of innovation on industrial talent clustering. In practice, innovative-oriented cities can produce talent clustering effects, while human clustering and human capital structure levels are capable of producing knowledge and diffusion effects, which is a reaction to regional technological innovation [29,30].

Through literature review, it can be found that there is plenty of literature focusing on the relationship between green innovation and industrial development quality. However, the connotation and extension of industry are very broad, with only a few studies relating directly to the pharmaceutical industry. Besides, when it comes to the research contents, the research on the relationship between green innovation and industrial development and talent development focused mostly on one-way impact analysis, which results in a shortage of the research on the impact of green innovation on the fusion of industry and talent. Thus, this paper is expected to enrich the research on the FIT and green innovation and to reveal the impact of green innovation on the FIT in the pharmaceutical manufacturing industry through quantitative empirical evidence, thus contributing ideas to further improving the level of FIT in China's Yangtze River Economic Belt.

2.2. Logic of FIT and Mechanism of Green Innovation's Influence on the FIT

2.2.1. Logic of the FIT

According to the theory of synergy, there is mutual influence and cooperation between various open systems with different properties in the environment [31]. In terms of regional economic development, industry-related and talent-related indicators are integrated to constitute a consortium through the mutual promotion of mutual constraint methods, with the coupling of industry and talent in the regional economy as the form or relationship that works together. The coupling suggests a strong correlation between two or more subsystems, as the subsystems are coordinated with each other, promote each other, or constrain each other [32]. After a unity is reached for the development score and coordination level of industry and talent, the coupling relationship becomes closer, which is referred to as fusion. In this paper, the pharmaceutical industry is represented by three dimensions: industrial scale, industrial efficiency, and industrial growth potential, with talent support divided into talent scale, talent structure, and talent effectiveness. Figure 1 shows the logic of FIT and the mechanism of the impact made by green innovation on the FIT.

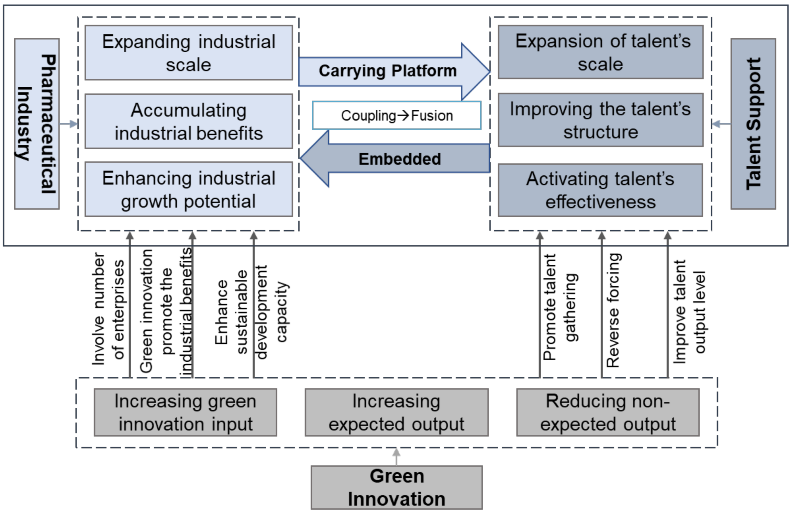


Figure 1. The logic of FIT and the mechanism of green innovation's influence on the FIT.

Under the FIT, the development, upgrading, and transformation of industry present a powerful platform for the concentration and development of talent resources [33]. In the meantime, the essence of talent development is embedded in industry, providing a solid supporting force for industrial development. On the one hand, from raw materials to product manufacturing, it is further extended to the upstream basic research and downstream market expansion. As every session of industrial development is inseparable from the support of talent, so the development and upgrading of the industry can be considered as the process of constantly investing in human resources for intellectual breakthroughs. On the other hand, the expansion of industrial scale and the accumulation of benefits provide abundant funds and comprehensive technical support for talent cultivation. As a result, there is an increase in returns, which induces the continuous expansion of talent scale and the optimization of talent structure and effectiveness. In addition, the stability and upgrading of industrial development show a new trend toward the high level and quality of talent support, which drives the optimization of talent structure and the improvement of talent effectiveness on a continued basis.

2.2.2. Mechanism of Green Innovation's Impact on FIT

In this paper, green innovation consists of green innovation input, expected output, and non-expected output. To achieve the purpose of promoting further integration of industry and talent, it is necessary to reinforce the carrying role of industry and enhance the supporting force of talent by increasing green innovation input and expected output and by reducing non-expected output.

As for the influence of green innovation on solidifying the industrial carrying role, it is mainly reflected in three aspects: expanding industrial scale, accumulating industrial benefits, and enhancing industrial growth potential. Firstly, promoting green innovation is not confined to reducing the consumption of resource inputs and pollution emissions in the production process. Instead, the emphasis should also be placed on increasing the demand for pollution control technologies, clean production processes, green intelligent equipment, and so on. This requires green technology innovation to be practiced in each enterprise, which in turn prompts enterprises to improve their R&D effectiveness constantly. Moreover, the diffusion of innovative technologies will involve more similar enterprises in transactions and cooperation, which is conducive to achieving industrial scale [34]. Secondly, improving the quality of R&D can help expand the innovative output of the industry and increase the industrial benefits continuously. Finally, green innovation can not only improve the material input and innovation environment of industrial innovation development but also promote the recyclability and sustainable development of industry. As a common theme of global economic development, the practice of the sustainable development concept will further drive the growth of industrial potential [35].

The influence of green innovation on enhancing the talent support force is reflected in the expansion of talent scale, as well as the improvement of talent structure and effectiveness. On the one hand, the economic and industrial development shows the trend of innovation, and the clustering of innovation talent is essential for innovation activities, which means the success or failure of innovation depends on the growth of innovative talents. Therefore, due to the enhancement of innovation capability, the talent team is required to meet the demand for innovation development by constantly optimizing and adjusting the quantity and structure of talents. On the other hand, promoting innovation development is conducive to creating a positive innovation environment and promoting the free flow of scientific and technological factors. This is a prerequisite to promoting the positive connection between the scale of innovation input and the level of talent output, ensuring the effectiveness of talent transformation and raising the overall level of talent support.

3. Index and Methodology

Starting with the establishment of an objective and comprehensive evaluation index system, this paper adopts the coefficient of variation method for weighting. On this basis, the model operation is carried out. Then, the comprehensive evaluation model (CEM) is used to measure the development score of subsystems and evaluate the development status of the pharmaceutical industry, talent support, and green innovation in the Belt. Moreover, the coordination model (CM) is applied to measure the status of coordination among various subsystems. Finally, to build the fusion model (FM) through a combination of CEM and CM, the FM is constructed to evaluate the degree of FIT, with the green innovation system included in the comparative analysis. In this way, the influence of green innovation on FIT is obtained.

The establishment of a reasonable, accurate, and scientific evaluation index system plays a vital role in the subsequent status quo and impact analysis. The CEM and the CM touch off from the overall dimension of each subsystem, showing a high level that has good complementarity as the basis for establishing the FM. The study is made more logical and complete due to a mutually complementary and cascading relationship between the establishment of the index system and model construction.

3.1. Evaluation Index System

Based on the reference to the relevant statistical yearbooks, public reports, and the analysis of evaluation scores of previous literature studies, this paper follows the principles of objectivity, systematicity, timeliness, and operability to explore the connotation and development needs of each subsystem, with an evaluation score system constructed on the subsystem layer, criterion layer, and index layer (Table 1).

Table 1. Pharmaceutical industry, talent support, and green innovation evaluation index system.

Subsystem	Criterion	Index	Notation	Weight [1]
Pharmaceutical industry	Industrial Scale	(+) Pharmaceutical manufacturing enterprises above designated size (#)	X_{11}	0.0275
		(+) Total assets (billion CNY)	X_{12}	0.0393
	Industrial Benefits	(+) Total profit of pharmaceutical manufacturing (billion CNY)	X_{21}	0.0359
		(+) Main revenue of pharmaceutical industry (billion CNY)	X_{22}	0.0306
		(+) Average number of employees (10 thousand CNY)	X_{23}	0.0326
	Growth Potential	(+) Total assets growth rate (%)	X_{31}	0.0324
		(+) Total profit growth rate (%)	X_{32}	0.0384
Talent support	Talent Scale	(+) Students enrolled in higher education institutions (people)	Z_{11}	0.0376
		(+) Health technicians per 1000 population (people)	Z_{12}	0.0400
		(+) Total employment (10 thousand people)	Z_{13}	0.0271
	Talent Structure	(+) Personnel in enterprise science and technology institutions (people)	Z_{21}	0.0272
		(+) Proportion of employees with a bachelor's degree or above (%)	Z_{22}	0.0361
		(+) Students enrolled in higher education per 100,000 people (people)	Z_{23}	0.0437
		(+) R&D personnel per 10,000 workforce (people)	Z_{24}	0.0361
	Talent Effectiveness	(+) Human capital stock (million people·year)	Z_{31}	0.0218
		(+) International scientific and technical papers collected by 10,000 people (pieces)	Z_{32}	0.0441
		(+) Effective invention patents for 10,000 people (#)	Z_{33}	0.0411
Green innovation	Green Innovation Inputs	(+) R&D internal funding expenditure (billion CNY)	Y_{11}	0.0389
		(+) Fiscal expenditure on science and technology (billion CNY)	Y_{12}	0.0424
		(+) R&D personnel full-time equivalent (people·year)	Y_{13}	0.0276
		(+) Total regional energy consumption (million tons of standard coal)	Y_{14}	0.0301
	Expected Outputs	(+) New product development projects (pieces)	Y_{21}	0.0317
		(+) Valid invention patents (pieces)	Y_{22}	0.0420
		(+) Revenue from sales of new products (million CNY)	Y_{23}	0.0318
		(+) Technology Market Turnover (RMB million)	Y_{24}	0.0527
	Non-expected Outputs	(−) Industrial wastewater discharge (million tons)	Y_{31}	0.0313
		(−) Industrial sulfur dioxide emissions (million tons)	Y_{32}	0.0507
		(−) Industrial solid waste emissions (million tons)	Y_{33}	0.0294

[1] The weights in the table are average weights, calculated using the coefficient of variation method in Section 4.2.

3.1.1. Pharmaceutical Industry

Regarding the indicators for the pharmaceutical industry, they have been studied mostly from such perspectives as industrial scale and industrial benefits [36,37]. In light of this, this paper integrates the criterion layer of industrial growth potential with the long-term and complex characteristics of pharmaceutical industrial development. Firstly, the industrial scale can be adequately reflected in the number of pharmaceutical manufacturing enterprises and total assets. Considering the large scale of the above-designated-size enterprises and the easy access to data, the relevant data are obtained from the above-designated-size enterprises. Secondly, industrial benefits can be measured in two dimensions: creating profit and driving employment. Therefore, three indicators are selected: total profit, main revenue, and the average number of employees in the pharmaceutical industry. Finally, the growth potential is measured against the growth rate of total assets and total profit.

3.1.2. Talent Support

Based on the Global Talent Competitiveness Index published annually by INSEAD and the experience of literature research [38], talent support can be measured in three dimensions: scale, structure, and effectiveness. Firstly, the talent scale indicates the number of talents, with three indicators selected from the ports of education and supply and demand: the total number of students enrolled into higher education institutions, the number of health technicians per 1000 population, and total employment. Secondly, talent structure is used to characterize the selection and allocation of talent elements, involving the number of personnel in enterprise science and technology institutions, the proportion of employees with a bachelor's degree or above, the number of students enrolled in higher education per 100,000 people, and the number of R&D personnel per 10,000 workforces. Finally, talent effectiveness is used to characterize the degree of expected results or impacts achieved by talent support, which can be measured by selecting the human capital stock, the number of international scientific and technical papers, and the number of effective invention patents per 10,000 people.

3.1.3. Green Innovation

According to the connotation of green innovation, and the indicators related to enterprise innovation activities as counted in the statistics yearbook on science and technology activities of industrial enterprises, a frequency analysis of the existing research indicators is conducted [39–41], with green innovation divided into three dimensions: green innovation inputs, expected outputs, and non-expected outputs. On the one hand, green innovation inputs include financial, human, and energy inputs. For this reason, there are four indicators selected: R&D internal funding expenditure, science and technology financial expenditure, R&D personnel full-time equivalent, and total regional energy consumption. On the other hand, according to the environmental sensitivity of green innovation, the green innovation outputs can be described from two perspectives: expected and non-expected. More specifically, the expected outputs include intermediate and final outputs. In the former, the number of newly developed products or projects and valid invention patents is selected. In the latter, two indicators are selected: new product sales revenue and technology market turnover. As for the non-expected output, it includes industrial wastewater, sulfur dioxide, and solid waste emissions.

3.2. Index Weighting

Calculating the weight of indexes is one of the important steps taken to produce the objective evaluation results which will have an impact on the accuracy and credibility of the evaluation. In this paper, the coefficient of variation is used to assign weights to the indicators. Based on statistical methods to derive the degree of variation of each index, the coefficient of variation method relies on the information carried by each indicator to reflect the gap between the current value and the target value of the indicator. The greater the degree of variation, the more difficult it is for the indicator to achieve the target value. In this case, a larger weight should be given and vice versa. In order to eliminate the influence caused by different scales, it is necessary to standardize the data and use the coefficient of variation for measuring the degree of difference and calculating the weight of each indicator. The specific calculation process is detailed as follows.

3.2.1. Data Standardization

Given the different dimensions of the selected score, it is necessary to standardize the data in the study. In order to prevent a 0 value of the standardized data, this paper adopts the post-polarity regularization method, with the original data value normalized to the interval [0, 1]. X'_{ij} and x'_{ij} represent the original value and standardized value, respectively. The standardized equations for positive indexes (1) and negative indexes (2) are presented as follows:

$$X'_{ij} = \frac{x_{ij} - min(x_{ij})}{max(x_{ij}) - min(x_{ij})} \times 0.99 + 0.01 \tag{1}$$

$$X'_{ij} = \frac{max(x_{ij}) - x_{ij}}{max(x_{ij}) - min(x_{ij})} \times 0.99 + 0.01 \tag{2}$$

3.2.2. Calculate the Weight Coefficient of Index

It is assumed that there are n samples and p indexes; then, the standardized data matrix is obtained:

$$X = \begin{pmatrix} x'_{11} & \cdots & x'_{1p} \\ \vdots & \ddots & \vdots \\ x'_{n1} & \cdots & x'_{np} \end{pmatrix} \mathrm{a} = 1,$$

Calculate the mean (3) and standard deviation (4) of each index.

$$\overline{x_{ij}} = \frac{1}{n}\sum_{i=1}^{n} x'_{ij} \tag{3}$$

$$S_{ij} = \sqrt{\frac{\sum_{i=1}^{n}(x'_{ij} - \overline{x_j})^2}{n-1}} \tag{4}$$

Calculate the coefficient of variation (5) and the weight (6) of each score.

$$v_{ij} = \frac{S_{ij}}{\overline{x_{ij}}}, j = 1, 2, \cdots, p \tag{5}$$

$$w_{ij} = \frac{v_{ij}}{\sum\limits_{j=1}^{p} v_{ij}} \tag{6}$$

3.3. Construction of Fusion Analysis Model

3.3.1. Comprehensive Evaluation Model

The development score of each subsystem can be measured against the internal weighting of the elements, i.e., the linear weighting of each evaluation score [42], while the development score evaluation functions of the pharmaceutical industry, talent support, and green innovation are expressed as follows:

$$f_A = \sum_{i=1}^{p} w_{ij} x'_{ij},\ f_B = \sum_{i=1}^{q} v_{ij} y'_{ij},\ f_C = \sum_{i=1}^{r} r_{ij} z'_{ij} \tag{7}$$

$$T_1 = \alpha f_A + \beta f_B \tag{8}$$

$$T_2 = \varepsilon f_A + \mu f_B + \gamma f_C \tag{9}$$

where f_A, f_B, f_C are the evaluation functions of the pharmaceutical industry, talent support, and green innovation, representing the development score of the three subsystems, respectively; w_{ij}, v_{ij}, r_{ij} represents the weight; T refers to the coordinated development score, which is used to reflect the overall synergistic effect or contribution of three subsystems;

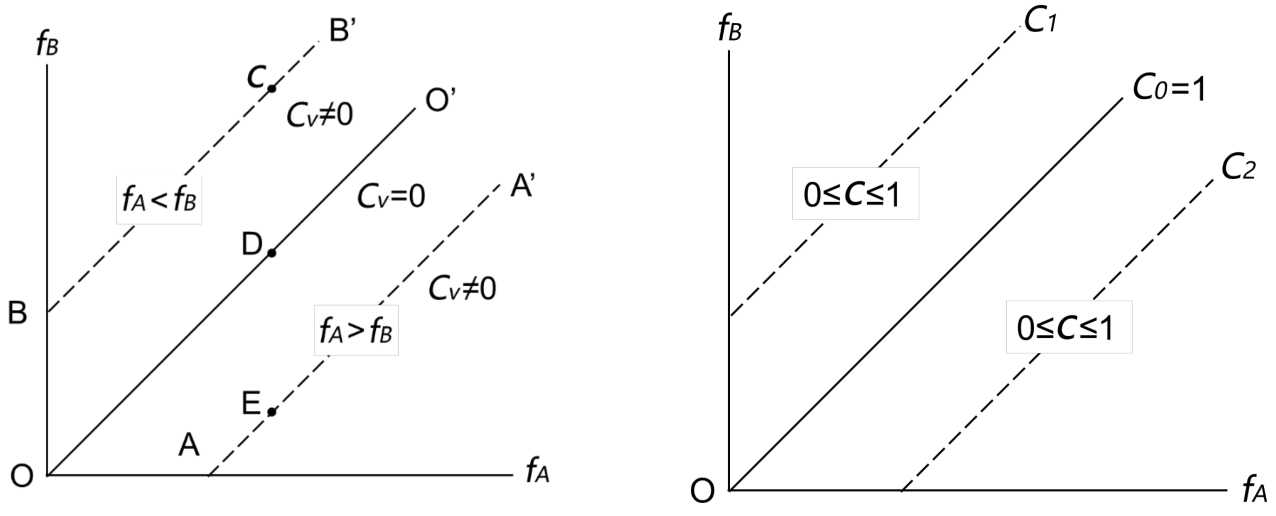
and α, β, ε, μ, and γ denote the coefficients to be determined ($\alpha + \beta = 1$, $\varepsilon + \mu + \gamma = 1$), representing the contribution coefficients of the pharmaceutical industry, talent support, and green innovation development in the two integration systems, respectively. The contribution coefficients of talent support and green innovation development are obtained as $\alpha = 2/3$, $\beta = 1/3$; $\varepsilon = \mu = \gamma = 1/3$ in this paper.

3.3.2. Coordination Model

The coordination model can be expressed by using the coefficient variation (C_V), and for the two systems A and B with internal linkages the C_V is expressed as:

$$C_v = \frac{\sqrt{\frac{(f_A - f_B)^2}{2}}}{\frac{1}{2}(f_A + f_B)} \tag{10}$$

where C_V represents the average degree of deviation between systems A and B. The smaller its value, the less significant the deviation and the stronger the coordination of the A–B system. Especially when $C_V = 0, f_A = f_B$, the coordinate point is exactly on the 45-degree ray OO′ emanating from the origin, as shown in point D of Figure 2a. Above this ray is the ensemble of $f_A < f_B$ coordinate points, which indicates a significant deviation of system B from system A, such as point C, whose deviation can be represented by the line CD. Below the ray is a considerable deviation of system A from system B, such as point E, whose deviation can be represented by line DE [43].



(**a**) (**b**)

Figure 2. Diagram: (**a**) deviation coefficient of A–B system; (**b**) degree of coordination of A–B system.

In order to make the A–B systems with different subjects comparable and to better present the characteristics of system coordination, Equation (10) can be converted into:

$$C_v = \sqrt{2(1 - C^2)} \tag{11}$$

$$C = 2\sqrt{\frac{f_A \times f_B}{(f_A + f_B)^2}} \tag{12}$$

Equations (11) and (12) are generally defined as the coordination degree of the system, and a smaller C_V indicates a larger C. As shown in Figure 2b, the three rays with slope 1 represent different coordination degrees, the points on the same ray have the same coordination degree, and the ray past the origin is the optimal coordination line with the coordination degree $C = 1$. Furthermore, any two rays symmetric about the optimal coordination line show the same coordination degree, for example, $C_1 = C_2$.

From Equation (12), the coordination degree of the multi-system can be obtained as

$$C = \mathrm{n} \times \left[\frac{f_1 \times f_2 \times \cdots \times f_n}{(f_1 + f_2 + \cdots + f_n)^n} \right]^{\frac{1}{n}} \tag{13}$$

3.3.3. Fusion Model

Fusion can be performed to characterize the integrated trend of coordination between subsystems and the development of subsystems. On the one hand, emphasizing development only may lead to low system coordination. For example, the four points F, G, H, and I in Figure 3 are located on a specific coordination line and equal development line, where points H and G have the same development score, but point H has a significantly lower coordination degree than point G, indicating a deviation in the A–B system. On the other hand, focusing on coordination only may result in a low development score of the system. For example, although points F and G have the same development score, point F has a much lower development score than point G. As indicated by point F, the A–B integrated system is in a "low development trap" [44].

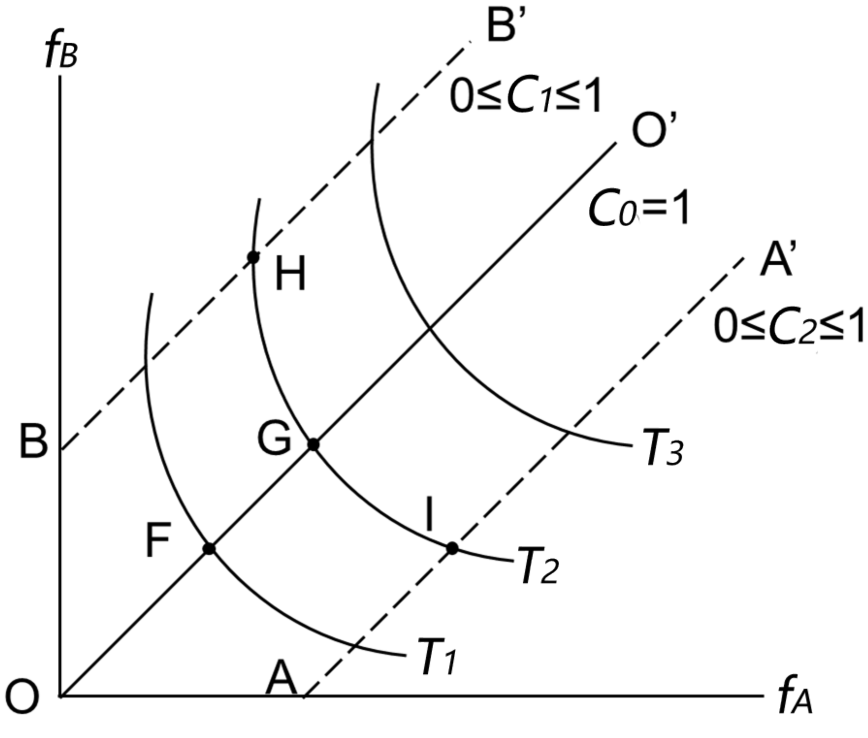


Figure 3. Degree of fusion diagram.

It can be seen that the fusion degree model should take account of both the development and coordination, which is expressed as

$$D = \sqrt{C \times T} \tag{14}$$

Therefore, according to Equations (8), (9), (13) and (14), the models of FIT before and after the inclusion of green innovation can be obtained as follows:

$$D_1 = \sqrt{2\left[\frac{f_A \times f_B}{(f_A + f_B)^2} \right]^{\frac{1}{2}} \times (\alpha f_A + \beta f_B)} \tag{15}$$

$$D_2 = \sqrt{3\left[\frac{f_A \times f_B \times f_C}{(f_A + f_B + f_C)^3}\right]^{\frac{1}{3}} \times (\varepsilon f_A + \mu f_B + \gamma f_C)} \quad (16)$$

In Equations (15) and (16), *D* represents the fusion degree. A higher *D* indicates a higher degree in the coordination of the fusion environment where the systems are located and vice versa. The degree of fusion can be classed into 10 levels, as shown in Table 2.

Table 2. Degree of fusion segmentation.

No.	Degree of Fusion	Level of Coordination	No.	Degree of Fusion	Level of Coordination
1	(0, 0.1)	Extremely Disordered	6	(0.5, 0.6)	Barely Coordinated
2	(0.1, 0.2)	Seriously Disordered	7	(0.6, 0.7)	Primary Coordinated
3	(0.2, 0.3)	Moderately Disordered	8	(0.7, 0.8)	Moderately Coordinated
4	(0.3, 0.4)	Mildly Disordered	9	(0.8, 0.9)	Well Coordinated
5	(0.4, 0.5)	Nearly Disordered	10	(0.9, 1.0)	Greatly Coordinated

3.4. Data

In this paper, 11 provinces and cities in the Belt are taken as the research object, with the period spanning from 2010 to 2019. The year 2019 is treated as the cut-off year because the COVID-19 pandemic has made a significant impact on the pharmaceutical manufacturing industry. However, the long-term valid data on the epidemic were unavailable when this study was conducted. Therefore, the impact of the pandemic on the pharmaceutical manufacturing industry is excluded. The data used in the three non-expected outputs of the green innovation system were sourced from *China Energy Statistical Yearbook* 2011–2020, while others were collected from the *China High-Tech Industry Statistical Yearbook* 2011–2017, 2019–2020, and *China Labor Statistical Yearbook* 2011–2020, as well as relevant provincial and municipal statistical yearbooks from 2011 to 2020. Some missing data were supplemented by the national economic and social development statistical bulletins, and the data that remained missing were added with linear interpolation, so as to gather the complete data on the three subsystems of 11 provinces and cities from 2010 to 2019.

4. Results and Discussions

4.1. Development Score Analysis of Pharmaceutical Industry, Talent Support, Green Innovation

The CEM and the complete data of 11 provinces and cities were used to measure the development score of the pharmaceutical industry, talent support, and green innovation (Figures 4–6).

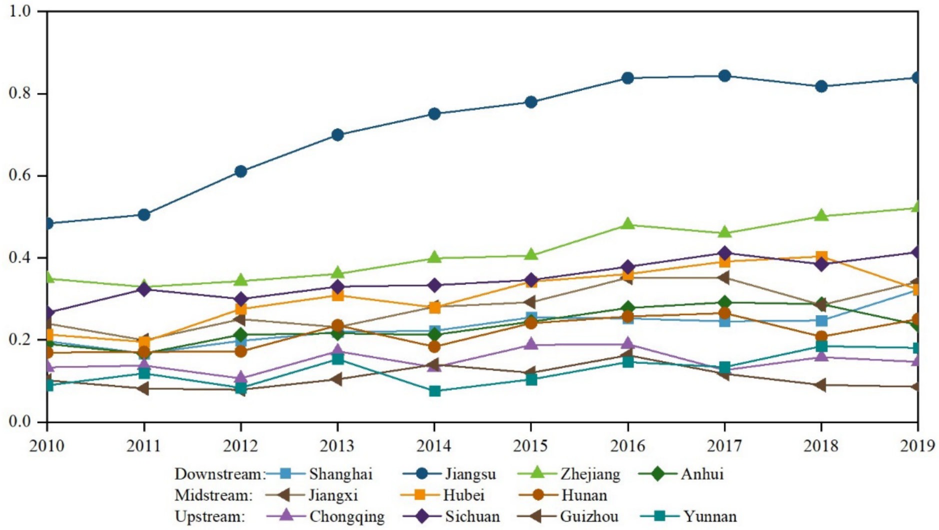


Figure 4. The trend of pharmaceutical industry development score in the Belt.

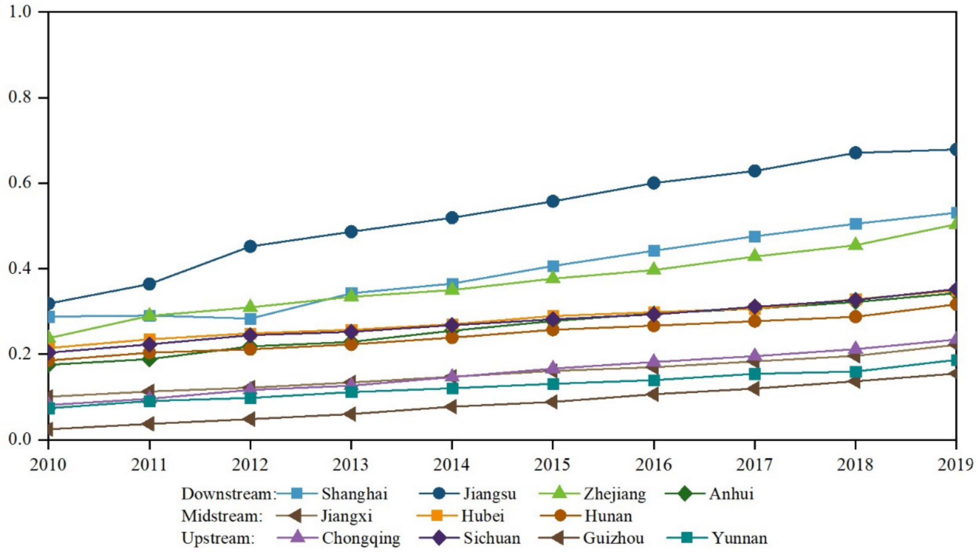


Figure 5. The trend of talent support development score in the Belt.

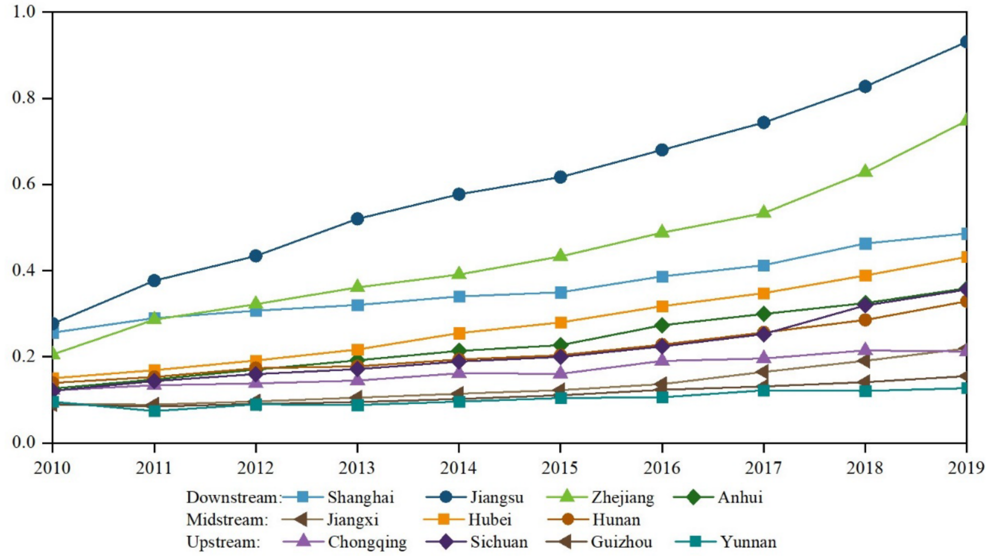


Figure 6. The trend of green innovation development score in the Belt.

The trend of changes in the pharmaceutical industry development score of the Belt is shown in Figure 4, which reveals that the overall level is low, fluctuating frequently. Due to the complexity of industrial development, the pharmaceutical industrial development score of all provinces and cities in the Belt shows significant fluctuations and slow-paced upward trends, with the GR of average value reaching up to 150% from 2010 to 2019 but with a low starting level, up from 0.22 to 0.33. Within the region, there are also large variations between provinces and cities. In the downstream region, Jiangsu province ranked first on six of the seven indicators from 2010 to 2019, taking the lead in the development of the pharmaceutical industry. However, the growth trend has slowed down in recent years, which is mainly because Jiangsu province has entered the late stage of transformation and upgrading of the pharmaceutical industry, and the industrial efficiency is slow to make improvement. Differently, the development score of Shanghai is similar to the level of the midstream region, ranking below the average. The upstream region of Chongqing, Yunnan, and Guizhou provinces is the lowest, which is attributed mainly to the disadvantage in geographical location and infrastructure construction. Despite being a municipality directly under the Central Government, Chongqing is also affected by the lack of industrial development momentum and weak industrial foundation, which results in the lagging development of the pharmaceutical industry. At the same time, Sichuan Province, which is located in the upstream region, represents the largest industrial manufacturing province in western China. Due to a solid industry foundation, a large scale of the pharmaceutical industry, and excellent industrial efficiency, the development score of Sichuan Province is far higher compared to other upstream provinces and cities in the third place in the Belt.

Figures 5 and 6 show the development trends of talent support and green innovation in the Belt, revealing the extremely strong similarities between the two subsystems. The first is growth stability. These two increased linearly from 2010 to 2019, and the average values of the two subsystem development indexes rose sharply from 0.17 and 0.15 in 2010 to 0.35 and 0.40 in 2019, with the GR reaching 200% and 260%, respectively. This is because, as one of the most dynamic economic regions in China, the Belt has always been giving priority to achieving economic quality and efficiency by strengthening of the green innovation drive and enhancing the openness to attract talent clusters. More specifically, Jiangsu province, with its strong industrial carrying capacity, achieved the most significant increase and ranked top in both green innovation and talent support development score. Besides, Zhejiang province and Shanghai city are also among the top three. As for the two provinces and one city with the strongest economic capacity in the Belt, their ranking status indicates that the traditional strong economic provinces and cities have obvious advantages in green innovation and talent support. Some provinces and cities are non-synchronous in two subsystems; for example, Guizhou province has a more significant effect in implementing the talent strengthening strategy, the scale of talent increases rapidly, and the talent structure-related score exceeds those of Yunnan province gradually. From 2010 to 2019, the talent support development score of Guizhou province improved from 0.025 to 0.15, which is the highest of the 11 provinces and cities with a CAGR of 22.7%.

The second is the development laddering. Both the two subsystems show divergence from two grades at the beginning of the study period to four grades at the end of the period, with the development differences becoming more significant. Grade I includes Jiangsu province, which has an absolute lead in all indicators. Grade II includes Shanghai city and Zhejiang province. According to Grades I and II, the downstream region provides the main driving force for the development of talent support and green innovation in the Yangtze River Economic Belt. Grade III includes those provinces and cities concentrating in the midstream region, such as Hubei province, Sichuan province, Anhui province, and Hunan province. Due to their similarity in geographical location, scientific and educational resources, and development foundation, the talent support development score is highly comparable between the four provinces. Grade IV includes Chongqing city, Jiangxi province, Yunnan province, and Guizhou province. Despite the low talent support development score of Grade IV, the CAGR rank is in the top four. In addition, it can be found out that the talent support and green innovation development score of all provinces and cities in the Belt have been improved to varying degrees. However, the laddering becomes increasingly obvious, showing an overall trend that the downstream region is stronger than the upstream region. That is to say, the significant improvement of talent support and green innovation levels in high-level provinces and cities plays a role in optimizing the talent support and green innovation development in medium- and low-level provinces and cities, although the increase becomes less significant, and the gap with high-level provinces is widened gradually.

4.2. Analysis of the Current Situation of the FIT in the Belt

Based on the fusion model, the current status of the FIT in the Belt from 2010 to 2019 was measured (Table 3). From the perspective of spatial characteristics, there are significant differences observed in the FIT in the Belt (Figure 7).

Table 3. The current situation of the FIT in the Belt from 2010 to 2019.

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average
Shanghai	0.3341	0.3167	0.3338	0.3567	0.3618	0.3856	0.3896	0.3907	0.3957	0.4358	0.3700
Jiangsu	0.4580	0.4753	0.5250	0.5560	0.5754	0.5897	0.6117	0.6179	0.6183	0.6250	0.5652
Zhejiang	0.3915	0.3971	0.4072	0.4194	0.4369	0.4446	0.4745	0.4738	0.4924	0.5077	0.4445
Anhui	0.3045	0.2951	0.3277	0.3320	0.3361	0.3571	0.3765	0.3851	0.3862	0.3658	0.3466
Jiangxi	0.2972	0.2864	0.3123	0.3096	0.3351	0.3448	0.3692	0.3746	0.3543	0.3841	0.3368
Hubei	0.3269	0.3222	0.3650	0.3811	0.3716	0.4022	0.4113	0.4244	0.4339	0.4073	0.3846
Hunan	0.2954	0.3009	0.3037	0.3401	0.3165	0.3510	0.3608	0.3669	0.3402	0.3682	0.3344
Chongqing	0.2373	0.2468	0.2344	0.2787	0.2624	0.3004	0.3058	0.2704	0.2953	0.2926	0.2724
Sichuan	0.3488	0.3776	0.3742	0.3883	0.3937	0.4018	0.4167	0.4328	0.4267	0.4428	0.4003
Guizhou	0.1736	0.1762	0.1826	0.2077	0.2391	0.2329	0.2654	0.2432	0.2276	0.2286	0.2177
Yunnan	0.2048	0.2328	0.2098	0.2622	0.2101	0.2369	0.2684	0.2651	0.2968	0.3024	0.2489
Average	0.3065	0.3116	0.3250	0.3483	0.3490	0.3679	0.3864	0.3859	0.3880	0.3964	0.3565
Max–Min	0.2844	0.2991	0.3424	0.3482	0.3654	0.3568	0.3462	0.3746	0.3907	0.3963	-

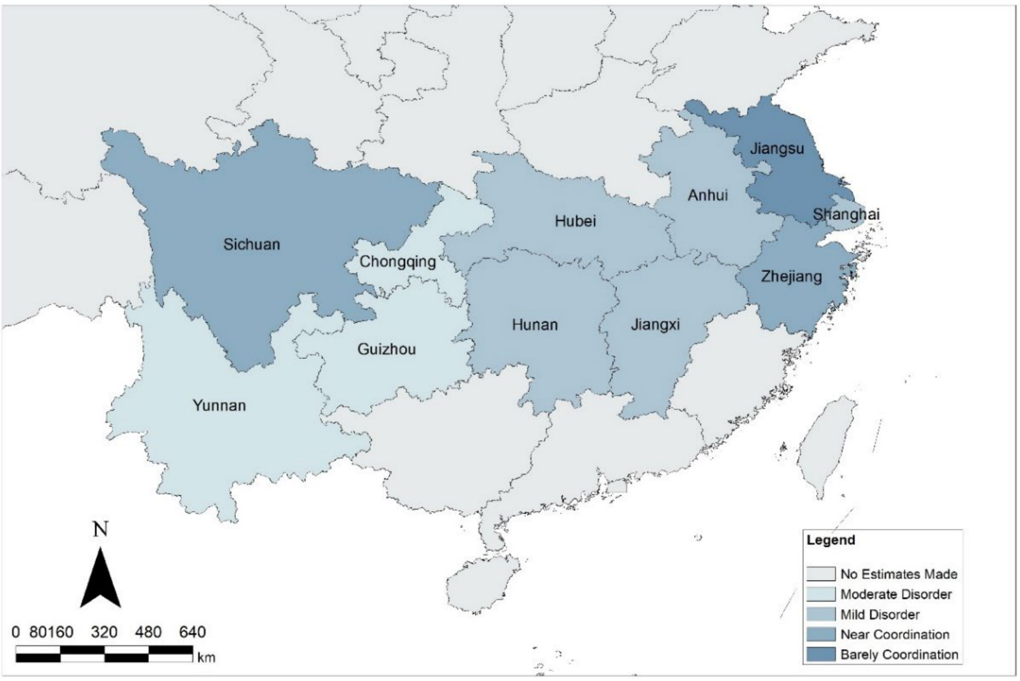


Figure 7. Spatial distribution of the degree of FIT in the Belt from 2010 to 2019.

From the perspective of time series, it can be found out that the degree of FIT is low, with more than half of the provinces and cities in the stage of disorder. The average degree value of FIT in the Belt showed an increasing trend from 0.307 to 0.396 during the period between 2010 and 2019, as maintained at a barely coordinated stage. Within the Belt, only Jiangsu province fell within the coordination range at the beginning of the study period, while all other provinces and cities were in the disordered stage, especially Guizhou province, which was in the stage of serious disorder. At the end of the study period, five provinces and cities were in the coordination stage, including Jiangsu, Zhejiang, Shanghai, Sichuan, and Hubei (degree of FIT > 0.40). Besides, there remained more than 50% of provinces and cities in the disorder stage, suggesting an improvement to the degree of FIT, despite not being to a significant level. Furthermore, the ranking of the degree of FIT has been consistent over the years, and there is an evident growth advantage in the upstream zone. Jiangsu province has always maintained the highest degree of FIT, followed by Zhejiang province, which is consistent with their ranking in the pharmaceutical industry and talent support development score. Among the four provinces and cities in the upstream region, Sichuan province ranks in fourth place, while Chongqing city, Yunnan province, and Guizhou city consistently rank bottom. The CAGR of the degree of FIT in

Yunnan and Guizhou provinces reached 4.4% and 3.1% during the study period, ranking first and third among the Belt, respectively.

From the perspective of spatial characteristics, it can be seen clearly that the degree of FIT in the Belt shows higher levels in the downstream region and lower levels in the upstream region. According to Figure 7, the 11 provinces and cities in the Belt can be divided into three tiers by their degree. The downstream region (Jiangsu province, Zhejiang province, and Shanghai city) belongs to tier one, while Anhui province, part of the midstream region (Hubei province, Jiangxi province, and Hunan province), and Sichuan province belong to tier two, followed by the upstream region (Chongqing city, Guizhou province, and Yunnan province), which belongs to tier three. As the core region of the Belt, tier one has a solid industrial foundation and geographical conditions that provide rich soil for FIT. Besides, the degree of FIT is high, especially in Jiangsu province, which remains above 0.5. By analyzing the data related to industry and talent in the tier two provinces and cities, it can be discovered that there is a necessity to improve the industrial benefits created by many pharmaceutical industrial enterprises and the level of the talent effectiveness, as this has resulted in the low development score in both dimensions, which further restricts the improvement of the degree of FIT. The upstream region has more space to improve the development score of each subsystem due to its geographical conditions and economic backwardness.

4.3. Analysis of Green Innovation's Impact on the Degree of FIT

In this paper, green innovation is introduced into the FIT system for a new round of processing (see Table 4 and Figure 8 for the results), with the resulting increase in the fraction of results over talent integration defined as the fusion difference (FD). A positive FD indicates a promoting effect of green innovation on the degree of FIT, while a negative FD indicates an inhibitory effect.

Table 4. The trend of FIT incorporating green innovation in the Belt from 2010 to 2019.

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average
Shanghai	0.4940	0.4914	0.5082	0.5375	0.5497	0.5753	0.5922	0.6031	0.6219	0.6606	0.5634
Jiangsu	0.5911	0.6407	0.7021	0.7492	0.7798	0.8029	0.8363	0.8562	0.8765	0.8996	0.7734
Zhejiang	0.5074	0.5487	0.5698	0.5932	0.6159	0.6358	0.6731	0.6869	0.7233	0.7625	0.6317
Anhui	0.4020	0.4087	0.4466	0.4602	0.4758	0.4989	0.5310	0.5471	0.5575	0.5548	0.4883
Jiangxi	0.3603	0.3551	0.3787	0.3851	0.4099	0.4235	0.4487	0.4690	0.4692	0.5055	0.4205
Hubei	0.4360	0.4449	0.4858	0.5083	0.5177	0.5502	0.5696	0.5889	0.6101	0.6045	0.5316
Hunan	0.4044	0.4179	0.4301	0.4589	0.4518	0.4827	0.5002	0.5159	0.5075	0.5449	0.4714
Chongqing	0.3317	0.3480	0.3462	0.3831	0.3831	0.4140	0.4329	0.4115	0.4395	0.4406	0.3931
Sichuan	0.4329	0.4671	0.4767	0.4927	0.5067	0.5187	0.5403	0.5646	0.5851	0.6108	0.5195
Guizhou	0.2467	0.2523	0.2651	0.2901	0.3219	0.3251	0.3591	0.3503	0.3471	0.3571	0.3115
Yunnan	0.2929	0.3046	0.3003	0.3385	0.3094	0.3352	0.3597	0.3692	0.3909	0.4034	0.3404
Average	0.4090	0.4254	0.4463	0.4724	0.4838	0.5057	0.5312	0.5421	0.5571	0.5767	0.4632
Max–Min	0.3444	0.3885	0.4369	0.4592	0.4704	0.4778	0.4772	0.5060	0.5294	0.5425	-

After the inclusion of green innovation, first, the degree of FIT increased progressively by two levels. At the beginning of the study period, only Jiangsu and Zhejiang provinces were at the stage of barely coordinated. Then, by 2019, except for Chongqing, Guizhou, and Yunnan provinces, which were in the slightly disordered stage, all other provinces and cities shifted from disorder to coordinated, crossing two levels on average, indicating that the impact of green innovation on the degree of FIT has been gradually enhanced and it is effective in promoting the development of FIT. Secondly, the absolute gap in FIT between provinces or cities shows a trend of expansion. From 2010 to 2019, the Max–Min degree of FIT rose from 0.3444 to 0.5425, which means there are at least three levels of the gap in degree of FIT at the same time point with the gap in expansion. According to Table 4, Jiangsu province, with the highest degree of FIT in 2019, was in the stage of good coordination, while Guizhou province remained in mild disorder, with a gap of five coordination levels between these two provinces.

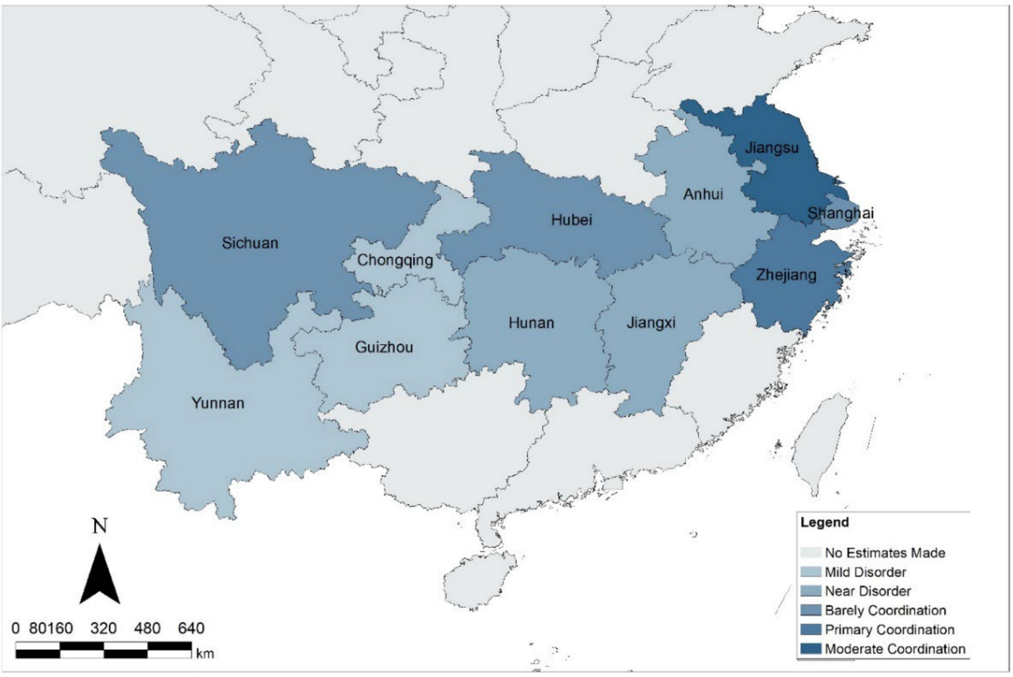


Figure 8. Spatial distribution of the degree of FIT incorporating green innovation in the Belt from 2010 to 2019.

Green innovation contributes to significantly improving the coordination of FIT. By comparing 110 sets of data collected from 11 provinces and cities from 2010 to 2019 in Tables 3 and 4, it can be known that 74% of the degree of FIT is in a state of disorder (degree of FIT < 0.4) before the inclusion of green innovation, with the proportion reduced to 25% after the inclusion, which suggests a positive FD on the data of all provinces and cities in all years. As discussed before, the fusion degree integrates two elements: the development score and system coordination. When the development score remains unchanged, the coordination of the fusion system will show a significant improvement, and the FIT will be further developed in such a highly coordinated environment.

With regard to the promotion of green innovation on the degree of FIT, it is affected by the basic level of the FIT. As shown in Tables 3 and 4, the average degree of FIT has increased significantly, by 39% on average, with the highest GR being 52% in Shanghai. Before the incorporation of green innovation, tier one provinces and cities (Jiangsu province, Zhejiang province, and Shanghai city) with the highest level of FIT had FDs of 0.208, 0.193, and 0.187, ranking the top three in the Belt. By contrast, Jiangxi province, Guizhou province, and Yunnan province with the lowest degree of FIT had the FDs of 0.084, 0.093, and 0.091, respectively, continuing to rank bottom. Therefore, those provinces and cities with a better base of FIT can achieve a larger FD. Table 4 also shows that the Max–Min difference of degree of FIT increased from 0.306 to 0.396 before the inclusion of green innovation and increased from 0.344 to 0.542 after the inclusion of green innovation, which reflects the difference in the level of influence exerted by green innovation on the FIT in different provinces and cities at the same time point.

5. Conclusions and Suggestions

In this paper, the logic of impact caused by green innovation on the FIT was analyzed, with the CDM and DM applied to evaluate the development score of three subsystems and to explore the promoting effect of green innovation on FIT across 11 provinces in the Belt. The main findings of our study are detailed as follows:

The development score of all three subsystems in the Belt maintains growth, with the time-series trends and rankings showing consistency, among which the development score of the pharmaceutical industry fluctuates significantly and shows low stability due to economic and policy influences. By contrast, talent support and green innovation show steady growth and obvious laddering. The development score of the three subsystems in Jiangsu province takes the lead in the Belt, while the development scores of each subsystem in the upstream region lags behind, especially Yunnan province and Guizhou province. Overall, the development score of the three subsystems shows a trend of pharmaceutical industry > talent support > green innovation. In spite of this, there are differences at the provincial and municipal levels, with Jiangsu province, Sichuan province, and Jiangxi province being dominated by the pharmaceutical industry. Shanghai city is a representative of the pharmaceutical industry lagging behind, while others have a similar development score for each subsystem, with no obvious leading and lagging situations.

The overall degree of FIT in the Belt is low, showing a distribution characteristic of "higher in the downstream and lower in the upstream." However, the growth trend is more evident in the upstream region. More than half of the 11 provinces and cities are in a state of disorder, but the level of improvement is insufficient. The downstream region (Jiangsu province, Zhejiang province, and Shanghai city) is tier one. Anhui province, the midstream region (Hubei province, Jiangxi province, and Hunan province) and Sichuan province are tier two, following closely behind. The upstream region (Chongqing city, Guizhou province, and Yunnan province) is tier three. Despite ranking the lowest in the degree of FIT during the study period, Yunnan province and Guizhou province rank first and third in the CAGR, respectively.

Due to the strong promotion of green innovation, the degree of FIT has shown improvement, which means green innovation has a promoting effect on provinces and cities in the Belt with a solid foundation of FIT. In terms of the mean value of fusion degree, the Belt is in mild disorder and moderate coordination at the end of the study before and after the inclusion of green innovation. At the provincial and municipal levels, the proportion of provinces and cities in the Belt at the coordinated stage and above reached 45% and 91% in 2019, which evidences that the environment of FIT has been significantly improved by green innovation. There is barely any change in the ranking of the degree of FIT before and after the inclusion of green innovation and the FD, implying that the provinces and cities with a better foundation of FIT have a greater FD, and the growth of FIT shows a "strong and stronger" momentum.

Based on the above findings, the following suggestions are made.

The government ought to focus attention on improving the development and efficiency of green innovation, thus promoting the FIT. As the economy and society develop on a continued basis, the upgrading of the FIT becomes increasingly reliant on green innovation. The Belt is supposed to formulate differentiated green innovation strategies based on the current status of the green innovation development score in each province and city, focus on supporting the leading provinces and cities (such as Jiangsu province, Zhejiang province, Shanghai city, Hubei province, and Sichuan province) to upgrade their green development levels, and offer an incentive for the lagging tier provinces and cities (such as Jiangxi province, Chongqing city, Yunnan province, and Guizhou province) to increase innovation investment and improve innovation output.

It is also necessary to promote the steady and sustainable growth of the pharmaceutical industry and talent support and to consolidate the foundation of fusion. On the one hand, the government shall devise a new strategic plan for the development of the pharmaceutical industry in the Belt and further improve the spatial layout of the pharmaceutical industry. The leading role of the downstream region, especially Jiangsu province, must be played to the fullest to create more demonstration areas for the development of the pharmaceutical industry. On the other hand, the government needs to accelerate the construction of talent attraction, gathering, and cultivation. At present, despite the strong attraction and retention of talent in the downstream region, it remains necessary for the upstream region to focus on local development strategies, strengthen the long-term planning of local talent development to train and exercise a number of local talents, and attract talents from outside the region through various forms and benefits, thus providing intellectual support at the same time.

It is also essential to narrow regional gaps by implementing regional coordinated development and interaction policies. The government should improve resource utilization, with the focus placed on strengthening the designation of industrial development policies, investment and management of scientific research funds, high-level technology, and high-tech talents in the upstream provinces and cities of the Belt. In addition, the government needs to enhance the exchange of experiences in pharmaceutical industrial development, talent support, and green innovation within the region through inter-regional support and technical assistance, which is crucial for increasing the development achievements in various aspects. Last but not least, the government ought to enhance the spillover effect within the region or neighboring areas and promote the synergistic progress of provinces and cities within the Belt.

Since the current work is limited by its data available for several indicators related to green innovation, as measured by two dimensions of "green" and "innovation", it is necessary to better characterize green innovation in disentangling the green effect through further work. In addition, the theoretical review of the related fields remains inadequate due to the lack of research on the development of multi-system fusion at home and abroad.

Due to the use of the fusion model, it can be determined that green innovation plays an active role in the FIT of the pharmaceutical manufacturing industry in the Yangtze River Economic Belt, so it is beneficial for the local government to implement the measures aimed at the coordinated development of the pharmaceutical manufacturing industry. Further work should be performed to identify the influencing factors and specific path to green innovation on the FIT according to the index system proposed in this study, which provides a new solution to the investigation of improving the relevance of optimal development.

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References

1. Jiang, L.; Zuo, Q.; Ma, J.; Zhang, Z. Evaluation and prediction of the level of high-quality development: A case study of the Yellow River Basin, China. *Ecol. Indic.* **2021**, *129*, 107994. [CrossRef]
2. Health Care's Climate Footprint. Health Care without Harm, ARUP. 2019. Available online: https://noharm-global.org/documents/health-care-climate-footprint-report (accessed on 22 May 2022).
3. Sun, L.W.; Cao, L. Construction and synergy analysis of green innovation system in Chinese manufacturing industry. *Technol. Econ.* **2017**, *36*, 48–55.
4. Liu, M.G. A study on the relationship between environmental regulation, green innovation and firm performance. *Technol. Innov. Manag.* **2020**, *41*, 539–547. [CrossRef]
5. Schiederig, T.; Tietze, F.; Herstatt, C. Green Innovation in Technology and Innovation Management—An Exploratory Literature Review. *R D Manag.* **2012**, *42*, 180–192. [CrossRef]
6. Huang, L.; Wu, C.Q. Research on the efficiency of green technology innovation and its dynamic mechanism in cities of Yangtze River Economic Belt. *J. Chongqing Univ. (Soc. Sci. Ed.)* **2021**, *27*, 50–64.
7. Liu, M.Y.; Yuan, B.L. Spatial heterogeneity effect of environmental regulation and green innovation efficiency–based on data of industrial enterprises in Yangtze River Economic Zone. *Financ. Account. Mon.* **2018**, *24*, 144–153. [CrossRef]

8. Holdgate, M. Our Common Future: The Report of the World Commission on Environment and Development. *Environ. Conserv.* **1987**, *14*, 282. [CrossRef]
9. Cooke, P. Regional innovation systems: Development opportunities from the 'green turn'. *Technol. Anal. Strateg. Manag.* **2010**, *22*, 831–844. [CrossRef]
10. Horbach, J. Determinants of environmental innovation: New evidence from German panel data source. *Res. Policy* **2006**, *37*, 163–173. [CrossRef]
11. Sezen, B.; Cankaya, S.Y. Effects of Green Manufacturing and Eco-innovation on Sustainability Performance. *Procedia Soc. Behav. Sci.* **2013**, *99*, 154–163. [CrossRef]
12. Zhang, J.; Kang, L.; Li, H.; Pablo, B.; Skitmore, M.; Zuo, J. The impact of environmental regulations on urban green innovation efficiency: The case of Xi'an. *Sustain. Cities Soc.* **2020**, *57*, 102123. [CrossRef]
13. Luo, Q.; Miao, C.; Sun, L.; Meng, X.; Duan, M. Efficiency evaluation of green technology innovation of China's strategic emerging industries: An empirical analysis based on Malmquist-data envelopment analysis index. *J. Clean. Prod.* **2019**, *238*, 117782. [CrossRef]
14. Eiadat, Y.; Kelly, A.; Roche, F.; Eyadat, H. Green and competitive? An empirical test of the mediating role of environmental innovation strategy. *J. World Bus.* **2008**, *43*, 131–145. [CrossRef]
15. Qu, K.J.; Liu, Z.M. Green innovations, supply chain integration and green information system: A model of moderation. *J. Clean. Prod.* **2022**, *339*, 130557. [CrossRef]
16. Jiang, Z.; Lyu, P.; Ye, L.; Zhou, Y. Green innovation transformation, economic sustainability and energy consumption during China's new normal stage. *J. Clean. Prod.* **2020**, *273*, 123044. [CrossRef]
17. Li, L.; Msaad, H.; Sun, H.; Tan, M.X.; Lu, Y.; Lau, A.K. Green Innovation and Business Sustainability: New Evidence from Energy Intensive Industry in China. *Int. J. Environ. Res. Public Health* **2020**, *17*, 7826. [CrossRef]
18. Fei, H.; Li, J. The impact of technology-based environmental regulation on industrial green innovation in resource-based cities-examples from the Yangtze River Economic Belt. *Urban Probl.* **2022**, *2*, 35–45+75. [CrossRef]
19. Li, L.; Jiang, F.; Pei, Y.; Jiang, N. Entrepreneurial Orientation and Strategic Alliance Success: The Contingency Role of Relational Factors. *J. Bus. Res.* **2017**, *72*, 46–56. [CrossRef]
20. Xia, Y.F.; Liu, P.S. Does Bank Competition Promote Corporate Green Innovation? Evidence from the Location of Bank Branches. *China World Econ.* **2022**, *30*, 84–116. [CrossRef]
21. Skordoulis, M.; Kyriakopoulos, G.; Ntanos, S.; Galatsidas, S.; Arabatzis, G.; Chalikias, M.; Kalantonis, P. The Mediating Role of Firm Strategy in the Relationship between Green Entrepreneurship, Green Innovation, and Competitive Advantage: The Case of Medium and Large-Sized Firms in Greece. *Sustainability* **2022**, *14*, 3286. [CrossRef]
22. OECD. Transitioning to Green Innovation and Technology (OECD Science, Technology and Industry Outlook 2012). *Innovation Policy Platform*. 2019. Available online: https://www.innovationpolicyplatform.org (accessed on 14 April 2022).
23. Fankhauser, S.; Bowen, A.; Calel, R.; Dechezleprêtre, A.; Grover, D.; Rydge, J.; Sato, M. Who will win the green race? In search of environmental competitiveness and innovation. *Glob. Environ. Chang.* **2013**, *23*, 902–913. [CrossRef]
24. Peng, W.B.; Wen, Z.Z. Green innovation and high-quality development of China's economy. *Jianghan Trib.* **2019**, *9*, 36–43.
25. Zhang, L. Environmental regulation, green technology innovation and manufacturing transformation and upgrading path. *Tax. Econ.* **2020**, *1*, 51–55.
26. Gallardo, E.; Nijs, S.; Dries, N.; Gallo, P. Towards an understanding of talent management as a phenomenon-driven field using bibliometric and content analysis. *Hum. Resour. Manag. Rev.* **2015**, *25*, 264–279. [CrossRef]
27. Chen, Q.H. Analysis of the mechanism of the role of environmental factors on population migration. *China Rural Surv.* **2015**, *3*, 87–95.
28. Jiang, X.; Wei, F.; Li, G.L. Can the improvement of living environment stimulate urban Innovation?—Analysis of high-quality innovative talents and Foreign direct investment spillover effect mechanism. *J. Clean. Prod.* **2020**, *255*, 120212. [CrossRef]
29. Feldman, M.P.; Audretsch, B.D. Innovation in Cities: Science-based Diversity, Specialization and Localized Competition. *Eur. Econ. Rev.* **2011**, *43*, 409–429. [CrossRef]
30. Mukim, M. Does Agglomeration Boost Innovation? An Econometric Evaluation. *Spat. Econ. Anal.* **2011**, *7*, 357–380. [CrossRef]
31. Hermann, H. *The Mystery of the Composition of Nature*; Shanghai Translation Press: Shanghai, China, 2013.
32. Li, Q.; Wei, Y.N.; Dong, Y.F. Coupling Analysis of China's Urbanization and Carbon Emissions: Example from Hubei Province. *Nat. Hazards* **2016**, *81*, 1333–1348. [CrossRef]
33. Da Silva, L.B.P.; Soltovski, R.; Pontes, J.; Treinta, F.T.; Leitão, P.; Mosconi, E.; De Resende, L.M.M.; Yoshino, R.T. Human resources management 4.0: Literature review and trends. *Comput. Ind. Eng.* **2022**, *168*, 108–111. [CrossRef]
34. Zhang, J.X.; Sun, X.R.; Li, H.; Philbin, S.; Ballesteros, P.; Skitmore, M.; Lin, H. Investigating the Role of Emissions Trading Policy to Reduce Emissions and Improve the Efficiency of Industrial Green Innovation. *J. Manag. Sci. Eng.* **2021**, *6*, 377–392. [CrossRef]
35. Trachuk, A.; Natalia, L. The Impact of Technologies of the Industry 4.0 on Increase of Productivity and Transformation for Innovative Behavior of the Industrial Companies. *Strateg. Decis. Risk Manag.* **2020**, *11*, 132–149. [CrossRef]
36. Tao, C.H.; Hu, M.; Shi, Y.X. Measurement of coupling coordination between medical service industry and pharmaceutical industry development and influencing factors. *Contemp. Financ. Econ.* **2021**, *2*, 11. [CrossRef]
37. Arnold, D.; Amato, L.; Troyer, J.; Stewart, O. Innovation and misconduct in the pharmaceutical industry. *J. Bus. Res.* **2022**, *144*, 1052–1063. [CrossRef]

38. INSEAD: Fontainebleau, France. The Global Talent Competitiveness Index 2020: Global Talent in the Age of Artificial Intelligence. 2020. Available online: https://knowledge.insead.edu/talent-management/global-talent-competitiveness-index-2932 (accessed on 12 June 2021).
39. Xiao, Y.; Wang, R.; Wang, F.; Huang, H.; Wang, J. Investigation on spatial and temporal variation of coupling coordination between socioeconomic and ecological environment: A case study of the Loess Plateau, China. *Ecol. Indic.* **2022**, *136*, 108667. [CrossRef]
40. Hage, J.; Hollingsworth, R. A Strategy for the Analysis of Idea Innovation Networks and Institutions. *Organ. Stud.* **2000**, *21*, 971–1004. [CrossRef]
41. Qian, L.; Shen, L.; Xiao, R.Q. Coupled coordination of green innovation and industrial structure optimization in Yangtze River Economic Belt and its spatial effects. *Bus. Res.* **2021**, *6*, 55–64. [CrossRef]
42. Azar, C.; Holmberg, J.; Lindgren, K. Socio-ecological indicators for sustainability. *Ecol. Econ.* **1996**, *18*, 89–112. [CrossRef]
43. Lu, J.; Zhou, H.M. An empirical analysis of the coupling relationship between human capital and economic growth in Chinese provinces. *J. Quant. Tech. Econ.* **2013**, *9*, 3–19. [CrossRef]
44. Wu, D.L.; Cao, F.D. Spatial and temporal characteristics and influencing factors of the coupling of tourism industry and informatization—Taking the Yangtze River Delta region as an example. *Jiang-Huai Trib.* **2021**, *1*, 29–36. [CrossRef]