Research Article

Research on the Spatial-Temporal Coupling Effect of Industrial Structure Upgrading and Human Resources in Western China

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Industrial development and human resources matching can better promote economic growth. The mismatch, incoordination, and noninteraction between the upgrading of the industrial structure and human resources in the western region have severely restricted the speed and quality of regional economic development. Based on the in-depth analysis of the coupling effect mechanism of industrial structure upgrading and human resources in the western region, this paper constructs an evaluation index system for industrial structure upgrading and human resources in the western region. The coupling coordination degree model was used to calculate and analyze the coupling degree and coupling coordination degree between the industrial structure upgrading and human resources in western China. The results show that from 2009 to 2018, the industrial structure upgrade and the level of human resources in the western regions continued to rise. Before 2015, the level of industrial structure was higher than the level of human resources, and then the opposite trend appeared. From the perspective of regional distribution, the coupling and coordination of the two systems in western regions are quite different. The upgrading of industrial structure and the coordination of human resources in the three regions of Shaanxi, Chongqing, and Sichuan are generally higher than those in other regions, but there was still a gap from the high-quality coupling state. Therefore, an in-depth understanding of the coupling stage, current situation, and problems of industrial structure upgrading and human resources in western regions will help to further promote the high-quality economic development of western regions.

1. Introduction

The upgrading of industrial structure is a process of advanced and rationalized industrial structure, which is inseparable from innovative activities and behaviors. [1] Human resources are a group of labor forces that form an organization, business sector, industry, or economy, and possess certain knowledge and skills, which can form innovation [2]. Therefore, the innovation drive required for the upgrading of industrial structure urgently needs the support and promotion of human resources. The traditional economic system was transformed and transited to the modern economic system, indicating that the traditional industrial system was transforming and developing to the modern industrial system. The internal industrial system turned from industry-oriented to service-oriented. The internal structure of each industry was gradually becoming advanced and promoting the high-quality development of the regional economy. Since the implementation of the new industrialization strategy, the rapid industrialization process of the western region has made the industrial added value of the western region accounted for approximately 17.5% of the national average annual rate from 2005 to 2016, and the growth rate is significantly ahead of the eastern and central regions. [3] As a carrier of advanced science and technology and a creative and active resource, human resources not only play a unique connecting role and multiplier effect in the combination of production factors but also promote the rapid development of various advanced productive and living service industries. This special economic resource is the most active factor of production that promotes economic development and runs through the entire process of the development of a modern economic system. [4] At the time of the formation of the new pattern of western development, the integration and coordination of the upgrading of the industrial structure and human
resources in the western region is of vital importance to the high-quality and sustainable development of the regional economy [5]. Compared with other studies, this research adopts the coupling coordination degree model to upgrade industrial structure in the western region and human resource system of measurement and analysis of the coupling and coupling coordination degree; the advantage is that it can further explore the western region of the industrial structure upgrade coordinate matching conditions, with the system of human resources and industrial transformation and upgrading and the suggestions for the development of human resource coupling.

2. Analysis on the Coupling Effect Mechanism of Industrial Structure Upgrading and Human Resources in Western China

The social economic system is a complex system, and various elements can continuously adapt to the external environment through interaction and adjustment, coordinate, promote, and develop with each other. The upgrading of industrial structure and human resources in the western region is two subsystems in the socio-economic system. Various elements between the two are constantly adapting, adjusting, promoting, and interacting with each other to achieve a state of coordinated development. While human resources promote the transformation and upgrading of the regional industrial structure, the upgrading and transformation of the industrial structure can also attract more excellent human resources to gather, so that the two systems interact with each other and achieve coordinated development.

2.1. Interactive Mechanism. Industrial upgrading is the process in which the industrial structure continues to be advanced and rationalized. [6] It is usually the shift from the primary industry to the secondary and tertiary industries and the gradual advancement of the internal structure of the industry. Human resources mainly reflect whether the quantity, quality, and structure of human resources in a stage meet the needs of the transformation of economic development mode and can provide the power and resources of sustainable development for regional economic development. Ordinarily, there is a benign interactive relationship between the upgrading of industrial structure and human resources. The transformation and upgrading of regional industrial structure provide a good environment and development foundation for the development and introduction of human resources. On the contrary, the agglomeration of human resources brings various innovations and power sources needed for the transformation and upgrading of the regional industrial structure. Specifically, the optimization and transformation of the industrial structure can attract more human resources, and the development and increasing availability of human resources can promote the continuous optimization and transformation of the regional industrial structure.

Zhaolei Zhan [7] pointed out that both human resources and the upgrading of industrial structure are important driving forces for modern economic and social development. There is a complex interactive relationship between the two, which promotes each other and restricts each other. [7] Achieving a benign interaction between the two is not only the inherent requirement of building a modern economic system but also the fundamental way to deal with the main contradictions in the new era.

2.2. Industrial Structure Optimization and Transformation Attract More Human Resources. In the process of upgrading the industrial structure and the flow of various production factors, high-quality human resource groups will spontaneously transfer to the region. In the process of upgrading the industrial structure, the market competitiveness within the region has greatly increased, and the production efficiency and technological development level have been continuously improved, resulting in rapid economic development. Regional development and the emergence of a new economy will attract and gather more production factors and create a large number of employment opportunities. Human resources, as one of the elements with strong mobility, will flow, migrate, and agglomerate with the development of new industries, new products, new services, and other emerging economies, thereby helping to promote the optimization and upgrading of the regional industrial structure and the high-quality economy developing [8].

Based on the annual data of 29 provinces (districts and municipalities) in China from 2010 to 2018, Sun Wei et al. [9] systematically summarized the different degrees of demand for human resources in the tertiary industry. They believed that China’s primary industry was becoming less attractive to employees at the present stage. The employment ratio of the secondary industry continues to increase, but at the same time, the ratio of its output value is decreasing. The absorption capacity of the tertiary industry to employees was rapidly improving, and the proportion of employees was increasing. [9] Thus, the industrial structure upgrading, which transited from industry-oriented and low-end internal industry-oriented to service-oriented and middle and high-end internal industry-oriented, had a great attraction and agglomeration effect on human resources.

2.3. Human Resources Can Promote the Regional Industrial Structure Optimization, Transformation and Upgrading. Human resources were the first resources to promote economic development and one of the key factors to promote economic growth. They played a vital role in the construction of the modern industrial system. Stable human resources are an important support for the optimization and transformation of industrial structure.

According to the theory of human capital, under the same other conditions, the higher the level of human capital accumulation, the higher the potential output level. High-level human resources could bring advanced technology, innovation vitality, and higher productivity for industrial transformation and the development of emerging industries, thus promoting the industrial structure transformation and upgrading the construction of the modern industrial system. In addition, the knowledge spillover effect generated by
human resources agglomeration would greatly promote the upgrading and transformation of regional industrial structure to high information, high intelligence, and high added value. Hence, as the most dynamic production factor, human resources have played a sound role in promoting the regional industrial structure optimization, transformation, and upgrading.

R.E. Lucas once pointed out: the driving force of a country’s economic growth and sustainable industrial development comes from the continuous accumulation of human resources. [10] Yonghui Gao et al. (2006) proposed that human resources are an important supporting force for the coordinated development of industrial structure. The supporting role of human resources in the adjustment of industrial structure lies in the increase in demand for products and labor services from human resource investment, which greatly promotes the development of product structure and industrial structure adjustment. [11] The construction of a modern economic system in western China means that the industrial structure is shifting from industry-oriented to service-oriented, and the internal industrial structure is gradually becoming more advanced. With the gradual maturity of the economic development structure, the employed population concentrated in the service sector, that is, the employment concentrated in the knowledge-intensive services such as science, education, culture, and health. [12] In terms of skilled personnel, a large number of skilled industrial workers who could adapt to the constantly changing process of production and a large number of knowledge-based industrial workers who could propose new process and technology professionals to solve problems together at the frontline of production and processing were the necessary conditions for the productization of new technologies. [13] Human resources were the most dynamic production factors in the process of promoting economic development. The knowledge spillover effect and innovation-driven development generated by human resources could promote the upgrading and transformation of industrial structure.

### Table 1: Human resources level index system.

| Primary index | Secondary index | Number |
|---------------|-----------------|--------|
| Human resources quantity (X1) | Number of employees (ten thousand persons) | X11 |
|  | Labor participation rate (%) | X12 |
| Human resources quality (X2) | Number of students in general institutes of higher education (ten thousand persons) | X21 |
|  | Number of research and development (R&D) (person) | X22 |
| Human resources structure (X3) | Employment proportion of secondary industry (%) | X31 |
|  | Employment proportion of tertiary industry (%) | X32 |

3. Index Selection and Study Methods

3.1. Index Selection. The index of industrial upgrading mainly referred to the process of upgrading and rationalization of industrial structure, which showed as the change of inter-industrial structure and intra-industrial structure [14] On the basis of Fengchun Li’s measurement of industrial structure upgrading, the optimization and upgrading level of industrial structure in western China was scientifically calculated. Its expression was as follows:

\[
Z = \sum_{i=1}^{3} X_i \cdot i \leq Z \leq 3. \tag{1}
\]

In the formula, \(i\) represented the proportion of each industry in the total output value, and \(Z\) represented the upgrading coefficient of industrial structure (\(Z\) was between 1 and 3). The smaller \(Z\) was, the lower the level of industrial structure upgrading was. Otherwise, it was the opposite.

Human resources were the first resources to promote regional economic development and industrial optimization and transformation. In the paper, on the basis of the study of Liang Shan and Guandong Song [15, 16], the level of human resources in western China was measured from three aspects, namely, human resources quantity, human resources quality, and human resources structure. The comprehensive index system was shown in Table 1:

The number of human resources is the basis for measuring the coordinated development of human resources and industrial structure upgrading in western China. The most direct manifestation of the coincidence between human resources and the regional industrial structure upgrading was whether the size of human resources at the present stage could meet the demand of industrial structure upgrading, thereby promoting regional industrial upgrading. In this article, the number of employed persons and labor participation rate are used to measure the number of human resources in western China.

Human resources quality was the inevitable requirement of regional industrial structure upgrading [17, 18] High-level human resources could promote the rapid development of new industries, thus promoting the continuous optimization of industrial structure. Adopting the number of students in general institutes of higher education and the number of research and test development (R&D) personnel could better measure the quality of regional human resources.

Human resources structure was the guarantee of regional industrial structure upgrading. The construction of regional modernized industrial system was inseparable from the human resources matching with its development structure. Maintaining the consistency and balance between the upgrading of industrial structure and the structure of human resources can effectively promote the high-quality development of the regional economy. Therefore, in this article,
the proportion of employment in the secondary industry and the proportion of employment in the tertiary industry were used to measure the human resource structure in western China.

3.2. Study Method. According to the above analysis, there was a coupling relationship between industrial structure upgrading and human resources in western China. The coupling coordination degree model was also widely used in the current studies on the relationship between them. Thus, in this article, the coupling coordination degree model was used to discuss the coupling relationship between the industrial structure upgrading and the level of human resources in western China.

The order parameters of the two systems of industrial structure upgrading and human resources were expressed by \( U_i \) \( (i = 1, 2, \cdots, n) \). Its \( j \) th index value was \( f_{ij} \), the maximum value of the \( i \) th order parameter was represented by \( \alpha_{ij} \), and the minimum value was represented by \( \beta_{ij} \). When \( f_{ij} \) was with positive and negative effects, the normalized values were as follows, respectively:

\[
U_{ij} = (f_{ij} - \alpha_{ij}) / (\alpha_{ij} - \beta_{ij}), \quad (2)
\]

\[
U_{ij} = (\alpha_{ij} - f_{ij}) / (\alpha_{ij} - \beta_{ij}). \quad (3)
\]

Among them, \( U_{ij} \) was the normalized value of \( f_{ij} \).

For the subsystems with both human resources in the upgrading of the industrial structure in the western region, the integration method is used to calculate the orderliness of the indicators within the two subsystems:

\[
U_i = \sum_{j=1}^{n} \lambda_{ij} \cdot u_{ij}, \quad \sum_{j=1}^{n} \lambda_{ij} = 1. \quad (4)
\]

Among them, \( \lambda_{ij} \) represented the weight of each evaluation index, and \( U_i \) represented the order degree of the subsystem.

The degree of mutual influence and interaction between the two systems was expressed by coupling function \( C \). The coupling function expressions of industrial structure optimization and transformation subsystem \( U_1 \) and human resource subsystem \( U_2 \) were as follows:

\[
C = 2\sqrt{U_1 \cdot U_2} / (U_1 + U_2). \quad (5)
\]

System coupling degree \( C \in [0, 1] \), the smaller the value of coupling degree \( C \), the worse the coupling relationship between industrial structure transformation and upgrading and human resources. Otherwise, it was the opposite.

To measure the degree of coordinated development between the two systems, the coupling coordination degree function was also introduced in the paper. The expression was as follows:

\[
D = \sqrt{C \cdot T}, T = \alpha U_1 + \beta U_2. \quad (6)
\]

\( D \) represented coupling coordination degree. \( T \) represented the comprehensive coordination index between the industrial structure transformation and upgrading and the human resources system. \( \alpha \) represented the weight of industrial structure transformation and upgrading on the overall system coordination effect, and \( \beta \) represented the weight of human resources on the overall system coordination effect. The weight coefficient was set to be 0.5 and was classified according to the coupling coordination degree \( D \) value.

4. Empirical Study

In this paper, 12 provinces (regions, cities) in western China were taken as the research object. The regional data from 2009 to 2018 was selected to deeply study the industrial structure upgrading and the spatial-temporal coupling and coordinated development of human resources in western China. The coupling degree and coupling coordination degree between the industrial structure upgrading and human resources in western China were compared and analyzed. The data in this article mainly come from the official websites of National Bureau of Statistics, official websites of the Bureau of Statistics of Provinces (regions, cities), China Statistical Yearbook, China Statistical Yearbook on Science and Technology, and statistical yearbooks of provinces (regions, cities).

4.1. Temporal Evolution Analysis. The curves in Figure 1 showed the industrial structure upgrading and the sequence parameter \( U_1 \), the human resource sequence parameter \( U_2 \), the coupling degree \( C \), and the coupling coordination degree \( D \) of the two systems in western China from 2009 to 2018.

From the perspective of the sequence parameters of the two systems, the industrial structure upgrade and the sequence parameters of human resources in the western region have shown an increasing trend from 2009 to 2018. And the growth rate of human resources is significantly greater than that of the industrial structure upgrade. After 2015, the order parameter value of human resources exceeded that of industrial structure upgrading. The order parameter value \( U_1 \) of industrial structure upgrading increased from 0.28 in 2009 to 0.36 in 2018 (0.08 percentage points rise). The order parameter value \( U_2 \) of human resources increased from 0.27 in 2009 to 0.51 in 2018 (0.24 percentage points rise). From 2015 to 2018, the upgrading speed of industrial structure in western China was relatively slow, while the development speed of human resources was relatively fast. The increase of the order parameter value \( U_2 \) of human resources was much higher than the order parameter value \( U_1 \) of industrial structure upgrading, which showed the development trend of human resources driving regional industrial structure upgrading.
According to coupling relationship, the coupling degree value between industrial structure upgrading and human resources in western China from 2009 to 2018 was between 0.782 and 0.949. The coupling degree showed an average level as a whole. The coupling degree of the two systems gradually increased from 0.903 in 2009 to 0.933 in 2019, showing a steady increasing trend. According to the coupling coordination relationship between the two systems, the coupling coordination degree value between industrial structure upgrading and human resources systems in western China increased from 0.493 to 0.628 from 2009 to 2018. The state of coupling coordination has been developed from the primary to the intermediate, but there was still a gap from the state of high-quality.

### 4.2. Regional Difference Analysis

According to the calculation results of order parameter values, coupling degree C, and coupling coordination degree D of industrial structure upgrading (U1) and human resources (U2) in 2009 and 2018 in the western provinces (districts and municipalities) (Table 3), it can be seen that:

The industrial structure upgrading and the human resources level in western China were significantly different in 2009 and 2018. In most provinces, the value of the two order parameters, coupling degree, and coupling coordination degree all showed a distinct increasing trend. Among them, the order parameters of industrial structure upgrading in Inner Mongolia remained the same, while the order parameters of human resources in Tibet and Guizhou decreased. According to the coupling degree of industrial structure upgrading and human resources in western China in 2009 and 2018, the coupling degree of Sichuan, Yunnan, Tibet, and Guizhou all increased to varying degrees, while the coupling degree of Shaanxi and Qinghai did not change, and the coupling degree of other regions all decreased. According to the coupling coordination degree, except for Guizhou, whose degree was unchanged, the degree of the other 11 provinces (districts and municipalities) all

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**Table 2:** Judgment standard and classification of coupling coordination degree.

| D value | Level 1 classification | Difference value between U1 and U2 | Level 2 classification |
|---------|------------------------|----------------------------------|------------------------|
| 0.9 < D ≤1.0 | Excellent coupling coordination | U1 − U2 > 0.1, U2 − U1 > 0.1, | Human resource lag type I A of excellent coupling coordination |
|          |                        | | Industrial optimization and transformation lag type I B of excellent coupling coordination |
|          |                        | | Synchronization type I C of excellent coupling coordination |
| 0.8 < D ≤0.9 | Sound coupling coordination | U1 − U2 > 0.1, U2 − U1 > 0.1, | Human resource lag type II A of sound coupling coordination |
|          |                        | | Industrial optimization and transformation lag type II B of sound coupling coordination |
|          |                        | | Synchronization type II C of sound coupling coordination |
| 0.6 < D ≤0.8 | Medium coupling coordination | U1 − U2 > 0.1, U2 − U1 > 0.1, | Human resource lag type III A of medium coupling coordination |
|          |                        | | Industrial optimization and transformation lag type III B of medium coupling coordination |
|          |                        | | Synchronization type III C of medium coupling coordination |
| 0.4 < D ≤0.6 | Primary coupling coordination | U1 − U2 > 0.1, U2 − U1 > 0.1, | Human resource lag type IV A of primary coupling coordination |
|          |                        | | Industrial optimization and transformation lag type IV B of primary coupling coordination |
|          |                        | | Synchronization type IV C of primary coupling coordination |
| 0 < D ≤0.4 | Forced coupling coordination | U1 − U2 > 0.1, U2 − U1 > 0.1, | Human resource lag type V A of forced coupling coordination |
|          |                        | | Industrial optimization and transformation lag type V B of forced coupling coordination |
|          |                        | | Synchronization type V C of forced coupling coordination |

**Figure 1:** Variation curve of coupling degree and coupling coordination degree between industrial structure upgrading and human resources in the western region from 2009 to 2018.
located there. It has been deeply influenced by the regional culture of "the youth do not enter Sichuan, the elders do not go out of Tongguan (Shaanxi).” Therefore, in the development process, China has basically formed a good situation of mutual promotion and coordination between the upgrading of industrial structure and human resources.

In 2018, the overall degree of coupling and coordination between the upgrading of industrial structure and human resources in the western regions has increased. Compared with 2009, it has entered a new stage. Many provinces have entered a state of moderate coupling and coordination, and Chongqing has already leading development to the stage of good coupling and coordination.

Among them, Sichuan, Shaanxi, Inner Mongolia, Gansu, and Guangxi were already in the stage of moderate coupling and coordination. Among them, Sichuan was in the lagging type of moderately coupled and coordinated human resources. Shaanxi is in the lagging type of moderately coupled and coordinated, while Guangxi, Inner Mongolia, and Gansu are all in the lagging type of moderately coupled and coordinated industrial optimization and transformation. This also shows that Sichuan needs to “make great efforts” in the introduction of human resources, while Guangxi, Inner Mongolia, and Gansu should vigorously promote the optimization, transformation, and upgrading of the industrial structure. Compared with these four regions, Shaanxi’s human resources and industrial structure upgrade coupling coordination status is generally good.

Yunnan, Xinjiang, Tibet, Guizhou, Qinghai, and Ningxia are in the primary coupling coordination stage. Among them, Guizhou has developed from a lagging type of initially coupled and coordinated human resources to a lagging type of initially coupled and coordinated human resources. It still needs to vigorously promote the upgrading and transformation of the regional industrial structure. Xinjiang, Tibet, Qinghai,

| Region         | U1   | U2   | C    | D    | U1 − U2 | Coordination type | U1   | U2   | C    | D    | U1 − U2 | Coordination type |
|----------------|------|------|------|------|---------|-------------------|------|------|------|------|---------|-------------------|
| Sichuan        | 0.67 | 0.08 | 0.63 | 0.49 | 0.59    | IVA               | 0.91 | 0.41 | 0.92 | 0.78 | 0.51    | IIIA              |
| Shaanxi        | 0.49 | 0.43 | 1.00 | 0.68 | 0.06    | IIIIC             | 0.53 | 0.45 | 1.00 | 0.70 | 0.08    | IIIIC             |
| Yunnan         | 0.33 | 0.04 | 0.63 | 0.34 | 0.29    | VA                | 0.43 | 0.25 | 0.96 | 0.57 | 0.19    | IVA               |
| Chongqing      | 0.35 | 0.22 | 0.97 | 0.53 | 0.13    | IVA               | 0.51 | 1.00 | 0.95 | 0.85 | -0.49   | IIB               |
| Guangxi        | 0.26 | 0.19 | 0.99 | 0.47 | 0.07    | IVC               | 0.35 | 0.58 | 0.97 | 0.67 | -0.23   | IIIB              |
| Xinjiang       | 0.18 | 0.23 | 0.99 | 0.45 | -0.05   | IVC               | 0.19 | 0.63 | 0.85 | 0.59 | -0.44   | IVB               |
| Inner Mongolia | 0.26 | 0.21 | 0.99 | 0.48 | 0.05    | IVC               | 0.26 | 0.60 | 0.92 | 0.63 | -0.33   | IVB               |
| Gansu          | 0.25 | 0.34 | 0.99 | 0.54 | -0.09   | IVC               | 0.32 | 0.85 | 0.89 | 0.72 | -0.53   | IIIB              |
| Tibet          | 0.13 | 0.40 | 0.85 | 0.47 | -0.27   | IVB               | 0.15 | 0.39 | 0.89 | 0.49 | -0.24   | IVB               |
| Guizhou        | 0.21 | 0.55 | 0.90 | 0.58 | -0.34   | IVB               | 0.35 | 0.32 | 1.00 | 0.58 | 0.02    | IVC               |
| Qinghai        | 0.16 | 0.25 | 0.97 | 0.44 | -0.09   | IVC               | 0.17 | 0.28 | 0.97 | 0.47 | -0.11   | IVB               |
| Ningxia        | 0.12 | 0.29 | 0.92 | 0.44 | -0.16   | IVB               | 0.14 | 0.40 | 0.88 | 0.49 | -0.26   | IVB               |

| Year | Forced coupling coordination | Primary coupling coordination | Medium coupling coordination | Sound coupling coordination |
|------|-------------------------------|--------------------------------|------------------------------|-----------------------------|
| 2009 | Yunnan                        | Sichuan, Chongqing, Guangxi, Xinjiang, Inner Mongolia, Gansu, Tibet, Guizhou, Qinghai, Ningxia | Shaanxi                      | —                           |
| 2018 | —                             | Yunnan, Xinjiang, Tibet, Guizhou, Qinghai, Ningxia | Sichuan, Shaanxi, Inner Mongolia, Gansu, Guangxi | Chongqing                   |
and Ningxia are currently in the lagging stage of initial coupling and coordination of industrial optimization and transformation. The introduction, training, and development of a large number of human resources are the key to promoting the economic development of these four places.

From the perspective of the order parameters of the industrial structure upgrading of Shaanxi, Chongqing, and Sichuan in 2018, the industrial development degree of these three places is much higher than that of other regions, and the economic development level is at a higher level. As the three leaders in the western region, its industrial structure upgrade and transformational development drive regional economic development, thus forming a continuous attraction to human resources, attracting most of the western regions’ high-quality human resources to these regions. From the perspective of human resources sequence parameters, Chongqing, Shaanxi, and Sichuan have relatively high levels of higher education and relatively large scale of high-quality human resources, which have formed a good guarantee and motivation for the upgrading of regional industrial structure and economic development, and further supported the regional industrial structure upgrading and development.

5. Conclusion and enlightenment

According to the results in the paper, with the implementation of the new pattern of Great Western Development and the construction of the modern economic system, the coupling degree and coordination degree between the industrial structure upgrading and human resources in western China have shown an upward and better development trend. The coupling coordination degree has risen to a new level on the whole, continuously developing from the primary coupling coordination stage to the medium coupling coordination stage. Among them, Chongqing has entered the sound coupling stage, but the overall coupling coordination relationship is poor.

According to the data of regional distribution, there are differences in the coupling coordination between industrial structure upgrading and human resources in western China. At present, Shaanxi, Chongqing, and Sichuan provinces upgrade the industrial structure and human resources coupling coordination of the overall improvement. However, most regions are in the medium and primary coupling stages, which is related to the industrial development and human resources level in these regions.

The early start of industrialization development in Shaanxi, Chongqing, and Sichuan was large, and the agglomeration of colleges and universities resulted by large number of colleges and universities both brought about the accumulation of talents, which laid a solid foundation for the accumulation of high-level human resources. In addition, the urban infrastructure, natural environment, and innovative development of these three regions were relatively superior and leading. They were more attractive to high-quality, innovative, and skilled human resources required by industrial transformation and development. In the long term, a virtuous cycle of coordinated development between industrial structure upgrading and human resources will be formed.

The organizational status, interaction, and influence between the upgrading of industrial structure and human resources are essentially a process from low-level coupling to high-level coupling between the two systems. At the same time, its coordinated development is also the key to improving the quality of economic development in western China. At present, there is still a lot of room for development in the coupling and coordination between the upgrading of industrial structure and human resources in western China.

Western China should seize the development opportunity, making full use of the resource endowment with regional characteristics in the region, and actively cultivating the innovative human resources that fit with the regional industrial structure upgrading under the background of the construction of modern economic system. It is necessary to increase investment in science and technology, promote innovation-driven development, match the development of the talent chain with the industrial chain, and promote coordinated and orderly coupling development of the two systems in western China.

Data Availability

The experimental data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The author declared that he has no conflicts of interest regarding this work.

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