# Analysis of Science and Technology Innovation, Economic Growth and The Construction of The Silk Road Economic Belt

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**Abstract:** The Silk Road Economic Belt is an important strategic concept of China, and it is also a rare historical opportunity for the development of western China. With the help of science and technology innovation to drive the economy, it is the power engine for the development of western China. Therefore, it is of great positive value to analyze regional scientific and technological innovation, economic growth and the establishment of the Silk Road Economic Belt. Based on this, this paper discusses the relationship among scientific and technological innovation, economic growth and the Silk Road Economic Belt based on the coupling model, and puts forward specific methods such as building an innovation system with enterprises as the core and Industry-University-Research government as the foundation, and building a scientific and technological innovation experimental area, in order to provide a shadow reference and help for the construction of China's Silk Road Economic Belt.

**Keywords:** Science and technology innovation; Economic growth; Silk Road Economic Belt

## 1 Introduction

The Silk Road is an important channel for the exchange and integration between the East and the West in ancient China. Nowadays, the idea of "Silk Road Economic Belt" put forward by China is a key historical opportunity for the development of western China. The construction of "Silk Road Economic Belt", the nationalization center of its industrialization system, and scientific and technological innovation are important driving forces to ensure economic development. Implementing scientific and technological innovation to promote economic growth, so as to achieve the effect of catching up later, is also the central strategy for the re-prosperity of the "Silk Road Economic Belt". From this perspective, the construction of the "Silk Road Economic Belt" is essentially a process in which the external promotion of opening to the outside world at a high level driven by innovation and the internal growth under the guidance of regional independent scientific and technological innovation alternate. For the "Silk Road Economic Belt", it is fundamental to ensure the healthy, stable and rapid development of the economy. Nowadays, scientific and technological innovation plays an

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important role in supporting the economy and society. It can be said that an ideal region where scientific and technological innovation and economic growth coordinate with each other has excellent competitive strength. Scholars Huo Yuan and Zhu Lulu (2018) also said that in the current stage of development, the mode of economic development began to change from factor-driven and investment-driven to innovation-driven, and technology and finance and scientific and technological innovation gradually developed into the wings of the stable development of regional knowledge economy. They affirmed the close relationship between scientific and technological innovation, economic growth and the Silk Road Economic Belt, and believed that promoting scientific and technological innovation would help promote the construction and development of the Silk Road Economic Belt. Taking Shaanxi Province as an example, the scholar Ha Lequn [1] (2020) proposed to promote the development of the Silk Road Economic Belt by adjusting the industrial cooperation structure and changing the original dependence on manufacturing, heavy industry and other industries into relying on advanced technology industries. It can be seen that scientific and technological innovation, economic growth and the construction of the Silk Road Economic Belt are closely related. Therefore, this paper discusses the dynamic relationship between scientific and technological innovation and economic growth in the western region under the background of "Silk Road Economic Belt", and confirms the effect of the dynamic relationship between scientific and technological innovation and economic growth on the coordination degree of "Silk Road Economic Belt" construction.

## 2 Establishment of dynamic coordination coupling model of the system

In order to discuss the dynamic coupling relationship between scientific and technological innovation and economic growth system and its influence on the "Silk Road Economic Belt". In this study, the equations of scientific and technological innovation system and economic growth system are established respectively, and they are set as f(A) and f(G). Combined with nonlinear system theory, the two system equations are as follows:

$$T=df(A)/dt=b1f(A)+b2f(G) \tag{1}$$

$$E=df(G)/dt=c1f(A)+c2f(G) \tag{2}$$

Among them, T represents the evolution equation of scientific and technological innovation system, E represents the evolution equation of economic growth system, and b1, b2, c1 and c2 respectively represent the main influence coefficients of the evolution equation. VT=dT/dt, VE=dE/dt, representing the speed of evolution. Set V=h (VT, VE) (Ha, 2020). According to the actual situation in the western region of China, the evolution of the two systems is monotonic, so V can be regarded as a monotonic function of VT and VE, so that the arctangent function can be used to clarify the evolution process of the two systems. The following formula can be obtained:

$$V=\theta=\arctan (VT/VE) \tag{3}$$

In the formula, θ represents the dynamic coupling degree of science and technology supporting economic growth system in the western region. Not only that, it can be considered that the regions with ideal dynamic coupling degree between technological innovation and economic growth have excellent competitiveness in China's "going out" strategy. It is of positive significance to promote the development of China's "Silk Road Economic Belt". Based on this idea, θ can be used as the main criterion to evaluate the synergistic promotion of the two systems to the establishment of the "Silk Road Economic Belt", and it is in a monotonous interval, with θ ranging from (-π/2, π/2) (Zhang, 2019) [2].

According to this, the main evolution state of the dynamic coupling system between economic growth and goose science and technology innovation system can be analyzed by combining θ. It is used to evaluate the synergistic effect of the two systems on the "Silk Road Economic Belt". Based on this model, the system will produce four different changes:

In the first state, that is, $90 < \theta < 45$, then the system is driven by scientific and technological innovation, and the economic growth is highly dependent on the drive of scientific and technological innovation. The synergy between the two systems can effectively promote the construction and development of the Silk Road Economic Belt. If θ is 45, the system is in the most suitable state of dynamic coupling development, and it belongs to the best state of synergistic promotion.

In the second state, that is, $45 < \theta < 0$, the system is in the growth mode of scientific and technological innovation, and the driving ability of scientific and technological innovation has been significantly strengthened. The interaction of the two systems has greatly promoted the construction of the "Silk Road Economic Belt". Especially when θ is 0, the system is in the initial position of economic growth driven by scientific and technological innovation, which proves that scientific and technological innovation will not play a significant role in promoting the construction of the Silk Road Economic Belt (Li, 2020) [3].

In the third state, that is, $0 < \theta < -45$, the system is in a state of insufficient scientific and technological innovation, especially when θ is-45, that is, it is in a state where the functions of the scientific and technological innovation system and the new economic growth system are completely opposite, which proves that the current regional scientific and technological resources are insufficient, and many scientific and technological resources are monopolized by other regions.

In the fourth state, that is, $-45 < \theta < -90$, the system is in a state of maladjustment of scientific and technological innovation, and the impact of scientific and technological innovation on economic growth is basically negligible, so the role of the construction of the "Silk Road Economic Belt" can also be neglected.

# 3 Dynamic coupling analysis results of regional science and technology innovation support system

## 3.1 Analysis of development trend

In this study, the sample information data of western China (as shown in Table 1) were substituted, and then the system information data were standardized, and the comprehensive

development level of the system was tested by principal component analysis. The results show that the dynamic coupling degree of scientific and technological innovation channel system in western China shows a trend of overall decline. Among them, the dynamic coupling degree of innovation-driven systems in northwest China has an obvious upward trend, while the dynamic coupling effect of the two systems in southwest China has weakened, and the decline is very obvious (Li, 2020) [4]. Not only that, but the dynamic coupling trend of scientific and technological innovation supporting economic growth in Northwest China and Southwest China shows a completely opposite trend. It can be seen that the coupling situation of scientific and technological innovation and economic growth system in Northwest China is more ideal than that in Southwest China. From the perspective of extrapolation trend of dynamic coupling evolution, the future coupling foundation of Northwest China is more ideal than that of Southwest China by promoting the construction of "Silk Road Economic Belt" through scientific and technological innovation.

Table 1: Science and technology innovation support capacity and economic growth index system

| | unit | index |
|---|---|---|
| Economic growth system (y) | One hundred million yuan | Gross Regional Product |
| | One hundred million yuan | Industrial growth value |
| | Yuan Dynasty (1206-1368) | Residents' consumption level |
| | Yuan/person | Per capita GDP |
| | One hundred million yuan | Investment in fixed assets of the whole society |
| Science and Technology Innovation Support System (X) | item | Domestic patent application acceptance |
| | One hundred million yuan | Technical market turnover |
| | One hundred million yuan | R&D expenditure |
| | ten thousand people | Internet users |

From 2012 to 2022, as shown in Table 2, the dynamic coupling degree of the system in the western region basically showed a trend of first increasing and then decreasing (Liu, 2020) [5].

Table 2: Dynamic coupling degree of coordinated development of scientific and technological innovation and economic growth in western China

| year | θ |
|---|---|
| 2012 | 38.67 |
| 2013 | 40.54 |
| 2014 | 41.52 |
| 2015 | 44.63 |
| 2016 | 46.81 |
| 2017 | 48.82 |
| 2018 | 49.91 |
| 2019 | 49.55 |
| 2020 | 47.35 |
| 2021 | 44.21 |

On the whole, however, the dynamic coupling trend of scientific and technological innovation supporting economic growth in Northwest China and Southwest China shows a rising trend and a falling trend (as shown in Figure 1), and Northwest China is more ideal than Southwest China.

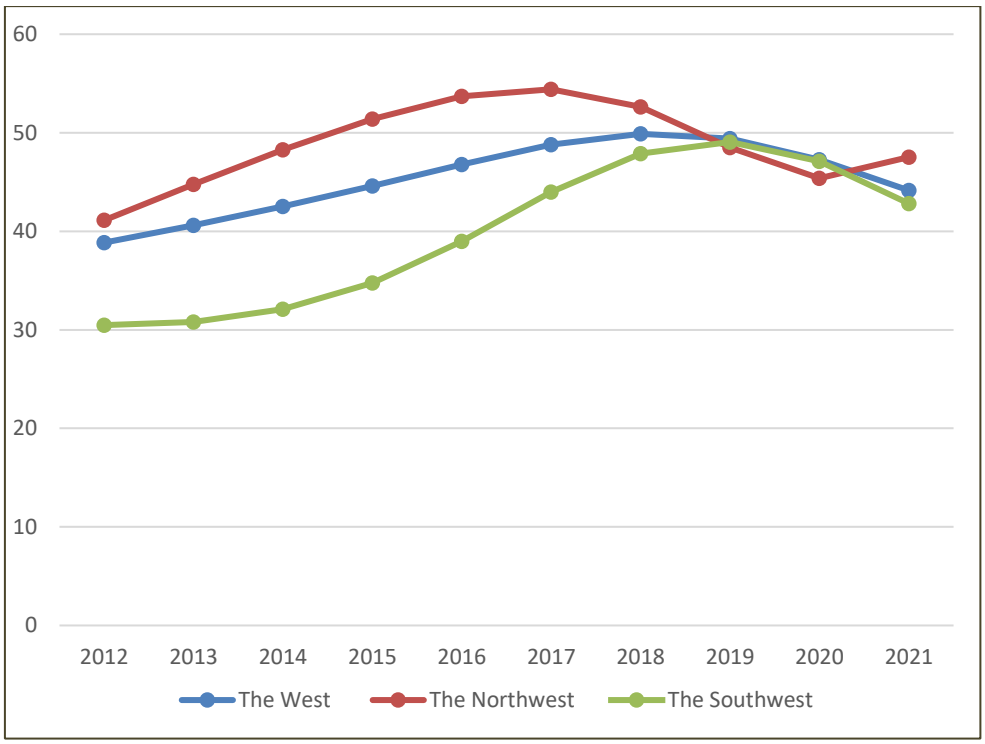


Figure 1: Changes of system dynamic coupling degree in western China

### 3.2 Analysis of the causes of development trends

The main reasons for the strong contrast between the development trends of southwest and northwest regions are as follows:

First, the northwest region is a traditional resource gathering region in China, which has more obvious advantages than the southwest region (Zheng, 2019) [6]. Therefore, the scientific and technological innovation based on resource development has a good development prospect. With China actively launching the western development strategy and providing a large number of supporting policies, the resource advantage can be gradually transformed into economic advantage, and the latecomer ability is constantly strengthened.

Secondly, in recent years, the economic construction in northwest China has obviously accelerated, the industrial structure has also undergone a very positive change, and the industrial competitiveness has been significantly strengthened. With the acceleration of industrial development, the northwest region has gradually realized the trend of scientific and technological innovation industry from tradition to modernization, so the strength of many scientific and technological innovation enterprises has also changed from weak to strong, and

scientific and technological innovation products have gradually developed from low-end to high-end, laying a good foundation for the construction of the "Silk Road Economic Belt" in this region. The dispersion of science and technology transmission gradually develops towards the new industrialization direction of agglomeration and cluster (Wang, 2019) [7].

Thirdly, the northwest region of China has always been the only way for the ancient Silk Road to connect China and the West, so the geographical advantage of developing westward is very obvious. Compared with the southwest region, the market in the northwest region is more open. With the rapid development of infrastructure connectivity, the space for international economic and technological cooperation has been further expanded, and the exchange capacity between human resources and materials has increased, which makes the scientific and technological innovation and economic growth in northwest China more vigorous (Zhang, 2019) [8].

# 4 Promote the establishment of the "Silk Road Economic Belt"

## 4.1 Build an innovation system with enterprises as the core and Industry-University-Research government as the foundation

First, give full play to the leading role of enterprises. Build a platform to promote the cooperation of Industry-University-Research government. China should actively encourage enterprises to build innovative platforms such as engineering technology centers and key laboratories, focus on industrial upgrading and chain expansion, highlight key points, and solve a number of important core technologies in a targeted manner, so that Chinese enterprises can occupy the commanding heights in many advantageous industrial fields. At the same time, it will provide funds and policy support for universities and research institutes at home and abroad, so as to build a technological innovation alliance between China and the West, build national and provincial R&D institutions, promote the continuous innovation of technology, management and format, and promote the capitalization and industrialization of scientific and technological achievements. Give full play to the positive value of universities and research institutes in China, encourage enterprises to emphasize the research of applied countermeasures in the process of strengthening basic research and cutting-edge technology research, actively participate in the public relations of key core technologies and research and development of key projects of various enterprises, promote the combination between research institutes and universities, and realize the sharing of technical resources and the sharing of benefits and risks between universities and research institutes. In addition, we will support various scientific and technological enterprises founded by universities and research institutes as the core, and improve the independent innovation capability of enterprises in all aspects. In addition, the government in the western region of China also needs to actively implement the R&D capability promotion function, and give key support to some innovative enterprises with excellent technical foundation, good development prospects and excellent driving ability in enterprise financing and development space expansion. Guide enterprises to build high-level R&D platforms such as technology centers, engineering research centers and engineering laboratories. At the same time, enterprises are encouraged to strengthen the introduction and cooperation of key technologies by means of cooperative shareholding and joint development, so as to improve the support of enterprise innovation policies and build a new system of

government support for enterprise technological innovation and management innovation (Liu, 2020) [9].

Second, establish a government-led public service platform for scientific and technological innovation. The government should fully guide the construction of science and technology, industry and social system, science and technology culture, etc., and promote the development of innovative culture. The industrial system construction should introduce, explore, cultivate and apply the policies, measures and mechanisms of high-end talents. On the basis of policy and mechanism innovation, we should take the government as the leading factor, promote the construction of a public service platform for scientific and technological innovation, establish a number of new R&D institutions that are conducive to scientific decision-making and achievement transformation, and build a large number of innovative enterprise groups, venture capital groups and intermediary service groups. Promote the system of Industry-University-Research's political cooperation, promote the benign interaction between innovation factors and production factors, and form an effective connection between innovation achievements and industries, so that the advantages of the government, universities, scientific research institutions and enterprises complement each other, and realize the two-way integration of technological innovation chain and industrial output. Strengthen the guiding ability of intellectual property rights, clarify the responsibilities and formal rights of all participants in Industry-University-Research government, make use of the market system, absorb the experience of Zhejiang, and build a cooperative innovation system of Industry-University-Research with enterprises as the core and close users, which is dominated by enterprises and funded to participate in the whole process of innovation.

### 4.2 Constructing a scientific and technological innovation experimental area

The key point of accelerating the construction of science and technology innovation pilot zones by local governments in the western region is to promote the timely reform of the government's science and technology and economic management system, and eliminate the problems existing in the government's management system of compartmentalization, dividing money and distributing goods. Therefore, local governments should know where the main battlefield is, focus and emphasis, analyze basic methods and ways, and know the origin of innovative culture. And whether different types of innovative talents really converge or not are the fundamental evaluation criteria for judging whether a region has an excellent innovation culture and innovation environment (Ma, 2020) [10].

As far as the basic conditions of politics, culture, economy, science and technology, etc., on which the development of the economic system in the western region of China depends, the western region has not yet had the foundation to comprehensively carry out the innovation-driven strategy. However, the western region has the basic conditions for all-round innovation of innovation channel strategy. The key point of establishing strategic emerging industries in the western region is to transform the potential technological disability of long-term storage into the kinetic energy of promoting development and innovation, which makes the technological advantages of the western region gradually leap to the industrial advantages and market competitive advantages, and constitutes a dynamic, competitive and radiating technological innovation-led promotion area of the whole province to promote regional strategic new development.

In addition, each local government should combine the characteristics of innovation areas to build a sound organization and coordination mechanism to ensure the rapid and stable promotion of the construction of science and technology innovation pilot areas. Science and technology innovation experimental area will enter a stage of rapid development, in order to ensure that all work can be carried out in sequence. The western region should set up a leading group responsible for the management and coordination of the science and technology innovation experimental zone, endow it with macro-management and regulation functions, and coordinate the important issues and matters arising from the construction work. In addition, the government of the western region needs to set up the management committee of the science and technology innovation experimental zone, which is fully responsible for the construction and promotion of the science and technology innovation experimental zone. The provincial government should give the management committee independent approval authority in the development and reform and environmental protection functions, and provide corresponding support for the establishment of the management system of the innovation experimental zone under the new situation.

## 5 Conclusions

The great idea of China's "Silk Road Economic Belt" is of great significance and value for promoting the economic development in western China, and is an important means to promote the balanced development of China's economy. Therefore, the government in western China should make clear the relationship between scientific and technological innovation and economic growth and its influence on the Silk Road Economic Belt, and at the same time, promote the development of the Silk Road Economic Belt by establishing a scientific and technological innovation experimental zone and an innovation system with enterprises as the core and Industry-University-Research government as the foundation.

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