

# Research on the Development of an Innovation-Driven Economy in the Bohai Rim

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**Abstract:** *With the in-depth promotion of the national innovation strategy, the Bohai Rim region is actively exploring and innovating new models of economic development. The Bohai Rim has advantageous conditions in terms of location, resources, industry, and education for the development of an innovation-driven economy. It shows a favorable trend of steadily increasing innovation investment, continuous improvement of the innovation environment, and enhanced quality of innovation output. Through data analysis and the measurement of rationalization, upgrading, and advanced levels of industrial structure, it is summarized that the Bohai Rim region faces several issues in the development of an innovation-driven economy, including regional disparities, weak industrial competitiveness, low rates of achievement transformation, and insufficient utilization of the bay area's advantages. Based on these issues, the following countermeasures are proposed: First, innovate the coordinated development mechanism for the innovation-driven economy in the Bohai Rim region. Second, enhance the advancement of industrial structure to strengthen industrial competitiveness. Third, improve the integration of industry, academia, and research to increase the conversion rate of scientific and technological achievements. Fourth, build an innovative bay area to expand the broad market.*

**Keywords:** *Bohai Rim; innovation-driven economy; industrial structure; technological innovation*

## 1. Introduction

Innovation is the primary driving force for high-quality economic development and serves as the strategic support for building a modern economic system. The report of the 20th National Congress of the Communist Party of China emphasizes the need to uphold innovation as the core position in the overall modernization efforts of China, focusing on the frontiers of world science and technology, the main economic battleground, major national needs, and people's health, accelerating the achievement of high-level self-reliance in science and technology. With the ongoing development of a new round of technological revolution and industrial transformation, global technological innovation is showing new trends and characteristics. The 2024 Government Work Report once again stressed the need to "promote high-level scientific and technological self-reliance." In recent years, with the in-depth implementation of the national innovation strategy, the Bohai Rim region has been actively exploring and innovating new models of economic development to achieve sustainable, healthy, and rapid economic growth[1].

## 2. Conditions and Current Status of Innovative Economic Development in the Bohai Rim

The Bohai Rim region is composed of Beijing, Tianjin, two municipalities directly under the central government, and 13 prefecture-level cities in Shandong, Hebei, and Liaoning provinces, surrounding the Bohai Bay. The area and population account for 5.4% and 17.7% of the country, respectively, while its GDP in 2023 accounted for 26% of the national total. As an important political, economic, cultural, and international exchange center in northern China, the Bohai Rim region plays an irreplaceable role in the revitalization of Northeast China and also serves as a driving force for the national economic development[2].

### 2.1. Conditions for Innovative Economic Development in the Bohai Rim

The Bohai Rim region has unique geographical advantages, providing spatial conditions for the development of an innovation-driven economy. Externally, the region connects with Japan, South Korea, Russia, Mongolia, and Southeast Asia, while internally, it links with coastal cities in southern China. In

terms of railways, the railway lines radiate across the country with Beijing as the center. Regarding highways, it has convenient intercity links, including expressways such as Beijing-Tianjin-Tangshan, Beijing-Shanghai, and Shenyang-Dalian. In water transport, the Bohai Rim surrounds Bohai Bay, with more than 40 ports such as Tianjin, Qinhuangdao, Yantai, and Dalian, creating opportunities for foreign trade[3].

The Bohai Rim region is rich in resources, providing a material foundation for the development of an innovation-driven economy. Most of the region lies in the North China Plain and the Liaohe Plain, with diverse agricultural products and sufficient supply and reserves. The region surrounds Bohai Bay and borders the Yellow Sea, thus enjoying abundant marine resources. It is worth emphasizing that the region is also rich in mineral resources. According to statistics, it has the largest iron ore reserves in China, and the reserves of coal, sea salt, petroleum, and rare metals are also among the top in the country.

The Bohai Rim region has a well-developed industrial system, creating possibilities for the development of an innovation-driven economy. The region has a solid industrial foundation, relying on traditional industries such as ports, steel, and coal. With the help of the Fourth Industrial Revolution and the development of information technology and the digital economy, traditional industries have been continuously upgraded and optimized, and strategic emerging industries have flourished, forming a relatively complete industrial system.

The Bohai Rim region has high-quality educational resources, providing intellectual support for the development of an innovation-driven economy. Due to the inclusion of Beijing and Tianjin, two municipalities, the region is one of the leading areas in China in terms of scientific and technological strength, becoming an important R&D base and a large concentration of intellectual resources. The Bohai Rim region has nearly 300 universities, and the number of researchers in universities and research institutes in Beijing and Tianjin alone accounts for one-fourth of the national total, which is quite significant[4].

## ***2.2. Current Status of Innovative Economic Development in the Bohai Rim***

In recent years, the Bohai Rim region has actively implemented the innovation-driven strategy, playing a crucial role in promoting the transformation and upgrading of the industrial structure in the region, achieving high-quality development, and enhancing new productive forces.

### ***2.2.1. Steady Increase in Innovation Investment***

The Bohai Rim region's innovation investment mainly focuses on four aspects. First, R&D investment in high-tech industries has been continuously increasing, providing financial support for technological innovation. This investment not only promotes the rapid development of high-tech industries but also optimizes the economic structure, increasing the added value and competitiveness of industries. Second, the construction of scientific and technological innovation platforms, such as laboratories, incubators, and maker spaces, has provided support for innovation and entrepreneurship. The construction of these platforms helps attract and train more high-end talents and provides support for enterprise technological innovation. Third, improving scientific and technological innovation policies and services provides an innovative environment for enterprises and innovation teams and ensures talent support for technological innovation. Fourth, increasing support for small and medium-sized enterprises (SMEs) enables them to enhance their competitiveness through technological and product innovation, making them an important force in promoting regional innovation development.

This study sorts out data from nine indicators, such as fiscal education expenditure and fiscal science and technology expenditure, for the Bohai Rim region from the "China Science and Technology Statistical Yearbook" (2016-2020). It is found that the proportion of science and technology and education expenditure in local fiscal expenditure has remained stable, and the total expenditure has steadily increased. The reason for the stability in proportion is that local fiscal expenditure has also been increasing year by year. Except for Shandong Province, the intensity of R&D funding has been increasing annually. In the past five years, Liaoning and Hebei provinces have shown an increasing trend in the number of R&D personnel and internal expenditure on R&D. In addition, the number of legal entities in scientific research and technical services, R&D expenditure of industrial enterprises above the designated size, and the number of high-tech enterprises have all increased annually in the Bohai Rim, excluding Shandong Province.

### ***2.2.2. Continuous Improvement of the Innovation Environment***

The development of an innovation-driven economy cannot be separated from a good business and

entrepreneurial environment. The improvement of the business environment for the development of the innovation-driven economy in the Bohai Rim region is mainly reflected in three aspects. First, policy support—local governments in the Bohai Rim region have introduced a series of policy measures to optimize the innovation environment and stimulate market vitality, such as tax reductions, financial support, and talent introduction, creating favorable development conditions for innovative enterprises. Second, the concentration of innovation resources—the Bohai Rim region brings together numerous universities, research institutions, and innovative enterprises, forming a relatively complete innovation ecosystem. The interaction and cooperation among these innovation resources have promoted the transformation and industrialization of scientific research results. Finally, the maturity of the financial market—the financial market in the Bohai Rim region is becoming increasingly mature, providing diversified financing channels for innovative enterprises, such as angel investment, venture capital, and the growth enterprise market, which support the commercialization of scientific and technological achievements.

The entrepreneurial environment in the Bohai Rim region is characterized by: First, a strong entrepreneurial atmosphere—along with an increasingly vibrant entrepreneurial atmosphere, the spirit of innovation has deeply taken root in people's hearts. Local governments have seized opportunities by organizing various entrepreneurship competitions and training programs to stimulate the enthusiasm for entrepreneurship. Second, a well-established entrepreneurship service system—the Bohai Rim region has gradually established a relatively complete entrepreneurship service system, including business incubation, project matching, and policy consultation, providing comprehensive support for entrepreneurs and reducing the barriers and risks of entrepreneurship. Third, abundant talent reserves—the Bohai Rim region has numerous universities and vocational training institutions, providing a rich talent pool for entrepreneurship.

### **2.2.3. Improvement in the Quality of Innovation Output**

As the evaluation standard for the development of an innovation-driven economy, output is the focus of attention. The output of an innovation-driven economy can be presented through the rationalization, upgrading, and advanced levels of the industrial structure. This study uses the Theil index to measure the rationalization of the industrial structure, the industrial structure level coefficient to represent the upgrading of the industrial structure, and Zhang Xinyan et al. (2023)'s calculation method to measure the advancement of the industrial structure. Data obtained from provincial "Statistical Yearbooks" and the "China Population Statistical Yearbook" were used to calculate the rationalization, upgrading, and advanced level indicators of the industrial structure in the Bohai Rim from 2018 to 2022. The closer the rationalization index of the industrial structure is to 0, the higher the level of industrial structure balance. The indicator shows that the industrial structure in Beijing, Tianjin, and Shandong is becoming increasingly rational, while there are fluctuations in Liaoning and Hebei. The industrial structure upgrading and advancement respectively reflect the proportion of the three major industries and the trend of structural changes. The measurement results indicate that the upgrading and advancement levels of each region in the Bohai Rim have remained relatively stable over the past five years, with Beijing showing particularly significant advancement.

The Bohai Rim region has injected new momentum into the development of the digital economy by leveraging technologies such as big data, cloud computing, and artificial intelligence. At the same time, the construction of digital infrastructure in the region has been continuously improved, providing a solid foundation for the further development of the digital economy. The Bohai Rim region has also actively promoted the R&D and application of green and low-carbon technologies, driving economic development in parallel with environmental protection. Due to the optimization and upgrading of the industrial structure and the rapid development of the digital economy, the economic benefits of the Bohai Rim region have continued to improve, significantly improving residents' living standards, with steadily increasing income levels, upgraded consumption structures, and continuous improvements in quality of life and well-being.

## **3. Problems and Countermeasures for Innovative Economic Development in the Bohai Rim**

Although the Bohai Rim region demonstrates advantages, momentum, and support for the development of an innovation-driven economy through innovation investment, environment, and output, the region also faces challenges due to the significant siphon effect of resources and talent, particularly with Beijing and Tianjin as central cities, and the disparities in the foundational conditions for innovative economic development across different areas. Therefore, it is necessary to summarize the issues and

propose targeted countermeasures and suggestions.

### ***3.1. Problems in the Innovative Economic Development of the Bohai Rim***

#### ***3.1.1. Regional Disparities***

The Bohai Rim region includes the capital city Beijing, the municipality Tianjin, and 13 cities across three provinces. Due to various factors such as history, geography, and policy, there are significant differences in economic development levels, social and cultural foundations, urban development positioning, and transportation among the different areas. Specifically, Beijing and Tianjin, as municipalities, have relatively strong economic bases and technological strengths. Shandong, located in the southernmost part of the Bohai Rim, not only has rich hinterland resources but also close ties with the Yangtze River Delta, and has developed rapidly in recent years, significantly outperforming Hebei and Liaoning. Liaoning, as the vanguard of the comprehensive revitalization of Northeast China, is affected by the lagging economy of the hinterland, and the difficulty of talent attraction is evident. These regional disparities hinder the coordinated development of the Bohai Rim region and limit the comprehensive implementation of an innovation-driven economy.

#### ***3.1.2. Weak Industrial Competitiveness***

The industrial structure of the Bohai Rim region is dominated by the secondary industry, with a large proportion of manufacturing and mining. These traditional industries not only have high energy consumption and pollution but also face high technical requirements for transformation and upgrading. For example, to upgrade and enhance the efficiency of traditional manufacturing industries such as steel, machinery, and chemicals, it is necessary to use intelligent transformation, green production, and industrial chain integration to enhance competitiveness. Although the development of emerging industries, such as new energy, new materials, and biomedicine, has injected new vitality into the regional economy, these industries are mostly in the initial stage, lacking core technologies and market competitiveness, which results in a low industrial level for the entire region and hinders the sustainable development of the innovation-driven economy.

#### ***3.1.3. Low Achievement Transformation Rate***

Technological innovation is the core driving force of an innovation-driven economy; however, the Bohai Rim region has significant shortcomings in the transformation of scientific and technological achievements. On the one hand, there is a disconnect between scientific research achievements and market demands, resulting in many promising scientific and technological outcomes failing to transform into actual productivity. On the other hand, the lack of efficient mechanisms and platforms for technology transfer means that the connection between technological innovation and industrial development is not smooth.

#### ***3.1.4. Insufficient Utilization of the Bay Area's Advantages***

The Bohai Rim region has several important bay areas, such as Bohai Bay and Liaodong Bay, which have unique geographical and resource advantages and are of great significance for developing an innovation-driven economy. However, the current role of these bay areas has not been fully utilized, as evidenced by the lack of clear industrial positioning, unclear development direction, and insufficient cooperation and synergy mechanisms within the bay areas, which have prevented the formation of joint forces to promote the development of an innovation-driven economy.

In summary, the Bohai Rim region faces issues such as regional disparities, weak industrial competitiveness, low achievement transformation rate, and insufficient utilization of the bay area advantages in the process of developing an innovation-driven economy. To promote sustainable development, it is necessary to formulate corresponding countermeasures and measures, strengthen regional coordinated development, enhance industrial competitiveness, optimize the technology transfer mechanism, and fully utilize the bay area's advantages.

### ***3.2. Strategies for Innovative Economic Development in the Bohai Rim***

#### ***3.2.1. Innovate the Coordinated Development Mechanism for the Innovation-Driven Economy in the Bohai Rim***

To achieve balanced development in the Bohai Rim region, it is necessary to innovate the coordinated development mechanism. The government should first strengthen intergovernmental cooperation and

communication, establish a regional coordinated development leading group, and coordinate the economic development of each region. Second, it should promote interconnectivity of infrastructure, such as building high-speed rail and highway networks to reduce logistics costs between regions and promote the flow of resources. Additionally, the government should establish regional market access standards and a unified regulatory mechanism to break down administrative barriers and promote market integration.

### ***3.2.2. Enhance the Advancement of Industrial Structure to Strengthen Industrial Competitiveness***

To address the weak industrial competitiveness in the Bohai Rim region, it is necessary to accelerate industrial structure adjustment and promote rationalization and upgrading of the industrial structure. The government should, on the one hand, increase support for high-tech industries and cultivate emerging industrial clusters to enhance the industrial level of the entire region. On the other hand, it should carry out technological transformation and upgrading of traditional industries to increase the technological content and added value of products. Moreover, the government should encourage enterprises to strengthen independent innovation and improve core competitiveness.

### ***3.2.3. Improve Integration of Industry, Academia, and Research to Increase the Conversion Rate of Technological Achievements***

To improve the conversion rate of technological achievements, the Bohai Rim region needs to strengthen the deep integration of industry, academia, and research. The government should first establish and improve cooperation platforms between industry, academia, and research institutions to facilitate collaboration and exchanges between research institutions, universities, and enterprises. Second, it should increase investment in scientific and technological innovation, raising the proportion of R&D expenditure to GDP and encouraging enterprises to invest more in technological research and development. Third, the government should improve the policy environment for the transformation of scientific and technological achievements by establishing a service system that integrates assessment, trading, and transformation of technological achievements.

### ***3.2.4. Build an Innovative Bay Area to Expand the Market***

The Bohai Rim region has multiple bay areas with development potential, and these resource advantages should be fully utilized to build innovative bay areas and expand the market. The government should first clarify the industrial positioning and development direction of each bay area to form a pattern of differentiated development and complementary advantages. Second, it should strengthen cooperation and synergy within the bay areas to promote the coordinated development of upstream and downstream enterprises in the industrial chain. Additionally, the government should increase support for innovation in the bay areas, attract high-end talents and high-quality resources, and build a high ground for an innovation-driven economy.

By implementing the above strategies, the Bohai Rim region can effectively solve the problems existing in the development of an innovation-driven economy, promote regional coordinated development, enhance industrial competitiveness, increase the conversion rate of technological achievements, and expand the market space. This is of great significance for promoting the sustainable and healthy development of the innovation-driven economy in the Bohai Rim region.

## **4. Conclusion**

In the process of developing an innovation-driven economy, the Bohai Rim region has made remarkable achievements in innovation investment, environment, and output by leveraging its advantageous geographical position and good development foundation. However, due to the inclusion of Beijing and Tianjin, as well as Liaoning, which shoulders the responsibility of the comprehensive revitalization of Northeast China, there are significant differences in the comprehensive foundation, development level, and policy measures among the regions. Therefore, the development of an innovation-driven economy in the Bohai Rim region needs to consider the strengths and weaknesses of each area and conduct planning, coordination, and allocation of resources from a macro perspective. The gradual transformation of the regional industrial structure towards rationalization, upgrading, and advancement not only enhances the industrial level of the entire region but also injects vitality into the development of an innovation-driven economy. Technological innovation is the core driving force for the development of an innovation-driven economy in the Bohai Rim region. In the future, the region needs to further strengthen the construction of the scientific and technological innovation system, improve scientific and technological innovation capabilities, and promote the transformation and application of

scientific and technological achievements. The Bohai Rim region has unique bay area resources, and in the process of developing an innovation-driven economy, it is necessary to continuously explore and innovate new models of bay area economic development. With the in-depth development of an innovation-driven economy, new forms of business are also emerging in the Bohai Rim region, such as the sharing economy, digital economy, and green economy. The development of these new forms of business not only enriches market supply but also improves the quality of life of consumers. In the future, the Bohai Rim region needs to increase efforts to cultivate and support new forms of business, promote the transformation of old and new growth drivers, and facilitate the diversified development of economic activities.

In the process of developing an innovation-driven economy, the Bohai Rim region has achieved significant success in terms of industrial structure, technology, models, and business forms. However, it also faces numerous challenges and problems that require continued efforts in reform and innovation to promote the sustained and healthy development of an innovation-driven economy.

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