



# A Research on the Development of Resource-Based Cities by Using the Big Data to Realize the Economic Transformation Taking Jining City of Shandong Province as an Example

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**Abstract.** The technological revolution, based on the big data, has exerted a huge impact on people's work and life styles. Currently, China has to simultaneously deal with the slowdown in economic growth, make difficult structural adjustments, and absorb the effects of previous economic stimulus policies, namely "the three-stage superposition". In view of this, it is an inevitable way to use the big data to realize the economic transformation for the upgrading of resource-based cities. On this basis, by taking Jining City of Shandong Province as an example, this paper analyzes the economic development of resource-based cities, and discusses how to get an adequate understanding of the characteristics of the economic "new normal", how to adapt to "the new normal" from the stage characteristics of the current economic development, and how to use the big data technology to realize the transformation from the demand management to the supply management. With a commitment to put the structural adjustment in a more prominent position, and make good use of the decisive role of the market in the allocation of resources, it is urgent to take effective measures to encourage innovation, strengthen the training of the personnel, and develop the tertiary industry, so as to promote the overall upgrading of the industrial structure.

**Keywords:** "new normal" of economy · the three-stage superposition · the big data

## 1 Introduction

From the reform and opening-up in 1979 to 2021, China's average annual growth rate of GDP has reached 9.9%, and the rapid growth over 40 years has created a miracle. Reviewing China's rapid economic growth for more than 40 years, it can be found that relying on the strong foreign demands, brought by the vast world market, had been an important factor in creating China's "economic miracle". China has been making full use of the demographic dividends, the resources and environment and other advantages to become "the world's factory". However, since the outbreak of the world financial crisis in 2015, each country has tried to adjust its development mode and accelerate the development

of its industries with comparative advantages, while China's foreign demands have been in a sluggish state, and the external environment for China's economic development has been deteriorating. Still worse, the sudden outbreak of the Covid-19 pandemic in 2020 exacerbated the world economy, and the international financial order has been trapped in chaos.

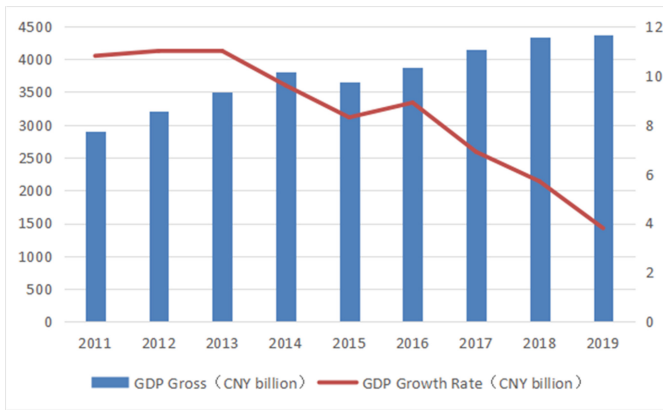
In May 2014, the General Secretary Xi Jinping first described China's economy with the term of "the New Normal" when he visited Henan, and pointed out that "China remains in an important period of strategic opportunities", and "we should adapt to the new normal from the stage characteristics of China's current economic development and maintain a normal mentality for strategies". In July, Xi Jinping proposed that "we should correctly understand the stage characteristics of China's economic development, further enhance confidence and adapt to the new normal". In December, for the first time, the Central Economic Working Conference fully and formally explained the characteristics of entering "the new normal of economy", and proposed that "understanding the new normal, adapting to the new normal, and leading the new normal are the major logic of China's economic development at present and in the future". At the APEC Summit of Industrial and Commercial Leaders, General Secretary Xi Jinping clearly pointed out that China's economy has shown to be in a new normal, and there are several main characteristics: First, the economy has shifted gear from the previous high speed to a medium-to-high speed growth. Second, the economic structure is constantly improved and upgraded, the consumption demands of the tertiary industry have gradually become the main body, the urban-rural regional gap has gradually narrowed, the proportion of residents' incomes has increased, and the development achievements have benefited the general population in a broader range. Third, the economy is increasingly driven by innovation instead of input and investment. [1] Fourth, the market is transforming from the basic role to the decisive role in the market allocation. Fifth, the economic well-being is transforming from the non-equilibrium type to the inclusive and sharing type [2].

## **2 The Economy of Jining City is in a Period of "The Three-Stage Superposition"**

"The three-stage superposition" refers to the special period of simultaneously dealing with the slowdown in economic growth, making difficult structural adjustments, and absorbing the effects of previous economic stimulus policies.

### **2.1 The Economic Growth Rate Gradually Declines and Enters the Slowdown Period**

During the period of the 11th Five-Year Plan (2006–2010), Jining City's economy has been soaring with an average annual growth of 14.3%. With the increase of such bases of the regional economic aggregate, and under the influence of such factors as the global economic slowdown, the speed of the economic development in Jining began to decline year by year. During the period of the 12th Five-Year Plan, the regional GDP in 2011 was CNY 289.67 billion, with an increase of 10.8%; the one in 2012 was CNY 321 billion, with an increase of 11%; the one in 2013 was CNY 350.154 billion, with an



**Fig. 1.** GDP Gross and GDP Growth Rate in Jining City

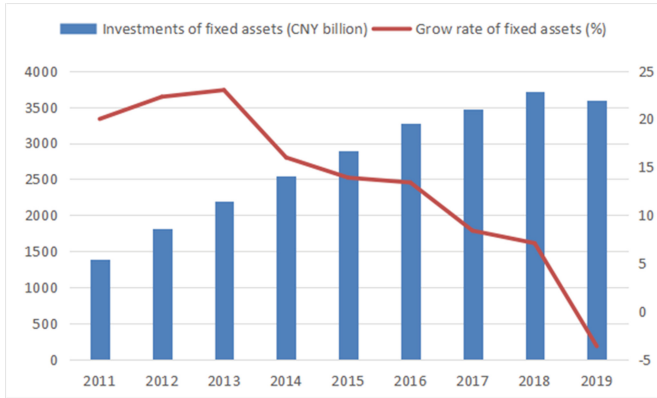
increase of 11%; the one in 2014 was CNY 380.06 billion, with an increase of 9.6%; the one in 2015 was CNY 365.81 billion, with an increase rate of 8.3%. During the period of the 13th Five-Year Plan, the regional GDP in 2016 was CNY 388.19 billion, with an increase of 8.9%; the one in 2017 was CNY 414.24 billion, with an increase of 6.9%; the one in 2018 was CNY 433.68 billion, with an increase of 5.7%; the one in 2019 was CNY 437.02 billion, with an increase of 3.8%. It can be seen from the above data that Jining is in a shift period of gradual slowdown in its growth rate (Fig. 1).

## 2.2 The Tertiary Industry Develops Rapidly and the Economic Structure is Adjusted Gradually

The slowdown in economic growth does not mean the recession of the economy, and the current slowdown in growth is “structural”, which is the slowdown in growth brought about by the structural adjustment, while the subsequently emerged sub-high-speed growth will become a continuous and stable “new normal”. In terms of the industrial structure, the proportion of the tertiary industry in regional GDP will be gradually increased in Jining city. In 2010, the proportion of the three industries in GDP was 12.6: 53.3: 34.1; by 2019, this proportion was 11.5: 40.3: 48.2. Not only did the total output value of the tertiary industry exceed that of the secondary industry, but its growth rate was also significantly faster than that of the secondary industry, which shows that Jining’s economic growth is increasingly dependent on the development of the tertiary industry.

## 2.3 The Effects of the Early Stimulus Policies Fade While the Negative Effects Appear

During the period of the 11th Five-Year Plan, Jining City has completed a total of CNY 442 billion in its investments into the fixed assets, and through the investments in real estates and other fixed assets, the economy in Jining has been promoted to develop rapidly. However, with the gradual increase in China’s regulation of real estates, the



**Fig. 2.** Investments and Growth Rate of Fixed Assets in Jining City

growth rate of the investments into the real estates in Jining City has gradually declined. By the period of the 13th Five-Year Plan, the proportion of the residential buildings declined by 7.7%, the one of the office buildings by 37.8%, and the one of the commercial housings by 21.2%, with a high destocking pressure. In a word, the negative impacts of digesting the early stimulus policies have hindered the further development of the economy in Jining (Fig. 2).

#### **2.4 The Low Prices of Resources Exert a Negative Impact on Jining's Economic Development**

Located in the southwest of Shandong Province, Jining City is endowed with abundant mineral resources, and there are more than 70 kinds of mineral resources that have been discovered and proven reserves in this city. This city is dominated by the coals with abundant reserves and high quality, prone to be mined. As a main production base of coals in China, it is not only the largest production base of coals in Shandong Province, but also one of the eight major coal bases that have been mainly developed in China. Since the 13th five-year period, the worldwide economic recession has caused the prices of the staple commodities including oil and coal to fall all the way. Affected by this, the profits of the mining industry, an important pillar industry in Jining, fell dramatically. In 2019, its profits decreased by 59.52%, and its profit tax decreased by 25.65%. With the constant deepening of China's economic structural adjustment and the advancement of the energy production and the consumption revolution, a sharp slowdown in the growth rate of the demands for coals will become the new normal of the change of the total quantity. Still worse, with the impacts of the golden 10 years of coals, the market supply of coals exceeded the demands, and it should be a difficult course for the coal market to digest the construction capacity ahead of time and the coal inventory. As a typical resource-based city, Jining must find new alternative industries, actively carry out economic transformation, and promote the healthy, rapid and sustainable development of the city's economy.

## **2.5 The Profits of the Traditional Advantageous Industries Decline**

In addition to the coal industry, the development of other traditional advantageous industries which drive the economic growth in Jining has slowed down. Among them, the profits of the textile industry increased by 5.6%; the ones of the manufacturing industry of the non-metallic mineral decreased by 2.06%; the ones of the industries of paper manufactures and paper products increased by 3.1%; the ones of the equipment-manufacturing industry (the manufacturing industry of general equipment) decreased by 30.35%. On the one hand, the residents' incomes increased, the cost of workers' labor increased, and the demographic dividends gradually disappeared, which squeezed the profit space of enterprises, especially the labor-intensive enterprises. On the other hand, the national digestion of the early stimulus policies and the slowdown in the global economic growth rate have affected the profit level of the heavy industry, especially the machinery-manufacturing industry. The decline of profits in Jining's traditional advantageous industries not only affects the scale of the enterprises' reproduction, but also has a negative impact on the growth of residents' incomes, which hinders the overall economic development of Jining City.

## **3 Correct Understanding for the New Normal of Economy**

### **3.1 The Slowdown of the Economic Growth Rate is Normal in the Medium-Income Society**

From the history of each country's economic development all around the world, a country's economy cannot always remain in an "excited state" of endless high-speed growth. Generally speaking, when its socioeconomic development reaches the medium-income level, its economy will decrease regularly and eventually reach a steady level. Taking Japan and South Korea in East Asia as examples, after experiencing a growth with an average annual growth rate of 9.7% from 1950 to 1972, Japan's economic growth fell back to 4.26% from 1973 to 1990, with the growth rate of 0.86% at present. Similarly, the average annual growth rate of South Korea reached 8.02% from 1961 to 1996, but decreased to 4.07% between 1997 and 2012 [3]. This decline is neither a simple slowdown in economic growth, nor an economic recession, but a result of the fact that the old growth impetus has found it difficult to play a positive role in the process of economic restructuring, while the new growth impetus, the effect of which has not yet been fully formed, was still in the process of cultivation and construction. For this reason, the economic growth is bound to be affected, especially in Jining City, when the regions of this city cannot reach the previous pace of development simply by relying on the advantages of resource endowments and human resources to develop the economy.

### **3.2 Under the New Normal of Economy, Structural Adjustment is as Important as Economic Growth**

Objectively speaking, the slowdown of the economic growth not only releases pressure for the structural adjustment of the economy, but also provides impetus for the structural optimization of the economy. For a long time, Jining City has been developed at a

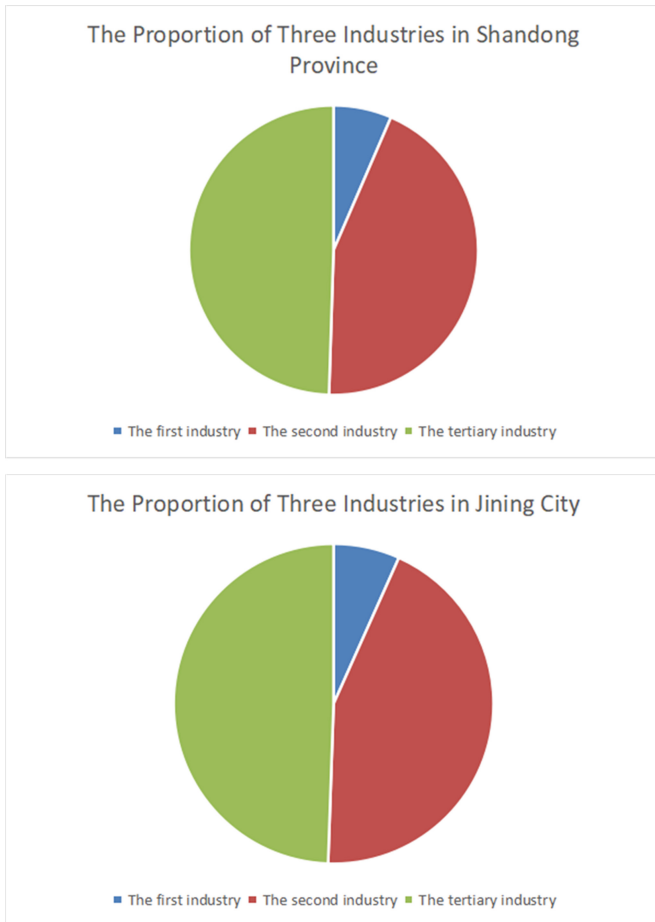
price of the structural imbalance in exchange for the high-speed economic growth. “Adjusting the structure” and “promoting the growth” cannot be taken into account at the same time: To promote the economic growth, it is necessary to give full play to the competitive advantages of traditional industries and the advantages of regional endowments, and invest a large number of social resources such as capital, manpower and policies into the traditional secondary industry, represented by the extractive industry and the manufacturing industry. Especially after the financial crisis in 2008, the climax of the asset investments across the country promoted the rapid development of the heavy industry in Jining. Correspondingly, it is relatively slow for the development of the high-tech industries and the tertiary industry, characterized by high technologies and high added values, with a relatively slow range of the adjustment of their economic structures. Under the new normal, appropriate economic growth is allowed to slow down in exchange for the optimization and improvement of the quality of the economic growth, and the slowdown in the economic growth brings new opportunities to the structural adjustment of the economy. At present, the tertiary industry in Jining is driven by a strong momentum of development, and has surpassed the secondary industry in terms of the development speed. However, from the perspective of the whole province, the proportion of the tertiary industry is still low in total, and has not yet reached the average level of the whole province (Fig. 3).

### **3.3 The Consumers’ Demands Replaced the Capital Investment and Turned to Be the Strongest Driving Force for the Economic Growth**

As to the “three carriages” which drive the economic growth, Jining’s consumers’ demands have gradually exceeded the capital investment and turned to be the most powerful driving factor. Under the new normal of economy, this state will still be maintained, and the consumers’ demands will effectively continue to make a greater contribution. Conversely, the role of the net exports has been weakening, and even a negative contribution rate has emerged in recent years. These facts fully demonstrate a current change in the core pattern of the economic growth in Jining. This adjustment is closely linked to the decline in the export competitiveness, resulting from the loss of the price advantage of the labor and resource factors across China. We should see that in the process of China’s gradual entry into the list of the medium-income countries, with the labor price continues to increase and the residents’ incomes rise steadily, it is an inevitable trend for the driving force of the economic growth to be shifted from investments and exports to consumption. It is also the necessary way to avoid the medium-income trap and ultimately achieve the transformation from the medium-income country into the developed country (Fig. 4).

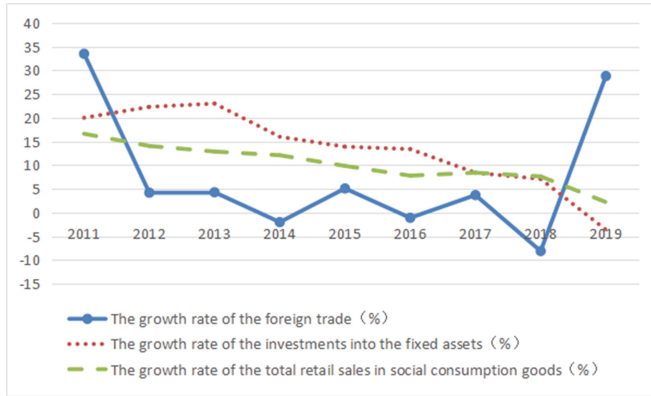
### **3.4 The Government Shifted from Demand Management to Supply Management**

Since the financial crisis in 2008, China has been implementing the policy device of demand management to regulate the economy. On the one hand, the government increased fiscal expenditure and the aggregate demands in economy through the government’s plans of large-scale investments, especially the demands for the excess capacity, thereby increasing the residents’ incomes and stimulating the economic growth. On the



**Fig. 3.** The Proportions of Three Industries in Shandong Province and Jning City

other hand, the central bank implemented the active monetary policy and fiscal policy to promote private investments and further increase the aggregate demands in society. The expansive fiscal policy and the active monetary policy have brought a period of rapid development of the national economy. Now, we can see that this mode of promoting the economic growth by stimulating demands can achieve significant results in a short term, but it is unsustainable in the long term. Facing the downward pressure of the economy, the new central government no longer relied on the policies of demand management to stimulate the economic growth and rebounds. On the basis of maintaining the stability of the monetary policy, it stimulated the market vitality and strengthened the endogenous power of the market. By encouraging innovation, it cultivated the new points of economic growth, increased the new market supply, released the potential for the long-term development and stabilized the growth rate, so that the economic operation continues to be in



**Fig. 4.** The Growth Rate of the Foreign Trade, Investments into the Fixed Assets and the Total Retail Sales in Social Consumption Goods in Jining City

a reasonable range, and the economic structure has been in the continuous optimization and upgrading.

## 4 Seizing the Opportunity to Embrace the New Normal of the Economy

China's economy has just reached the medium-income level, and it is able to realize a successful transformation and upgrading, as well as eventually get access to the ranks of the developed countries. Otherwise, it will get stuck in the medium-income trap for a long time, the contradiction of its economic structure will further deteriorate, its growth momentum will be insufficient, its economy will continue to be sluggish and even decline, and its industry will remain at the low end of the global industrial chain for a long time, with seriously unfair income distribution and frequent economic crises and social crises.

For these reasons, Jining City needs to seize the opportunity to solve the various outstanding problems in the economic structure, and reform the various institutional and mechanical obstacles that restrict the economic development and upgrading, so as to smoothly transmit the economy to the new normal.

### 4.1 Encouraging the Innovation of the Technological and Commercial Modes, Moving Towards the Two High-Ends of the Research and Development and the Marketing of the International Value Chain, and Shifting the Growth Momentum of Jining from the Traditional Factors to the Innovation

Focusing on the traditional advantageous industries in Jining City, an enterprise-centered innovation system shall be established to form an innovative mode of production, learning and research with a combination of the government, the enterprises, the universities and the scientific research institutions. Through the effective cooperation and the risk sharing, the cost of research and development shall be reduced, the circle of research and



development shall be shortened, and the abilities of independent research and development as well as innovation shall be improved. Through the continuous introduction and application of the achievements of the digital technologies, the traditional manufacturing industry in Jining City shall be successfully upgraded. At the same time, by promoting the innovation of the enterprises' technologies and the commercial mode, it shall stride to "the smiling curve" at both ends. Meanwhile, by increasing the investments into the research and development through the tax relief and the financial subsidies, the small-and-medium-scale enterprises and the emerging enterprises shall be provided with the basis and platform for their development, and the integration of the industrial supply chain and its operation framework shall be strengthened. The focus of the economic growth in Jining City shall be shifted to increasing the supply which can generate and create new and larger demands through innovation, thereby boosting the domestic demands while eliminating the backward production capacity.

#### **4.2 Giving Full Play to the Decisive Role of the Market in the Allocation of Resources, and Transforming from the Government-Led Growth Mode to the Market-Dominated Growth Mode**

Jining City should liberate its thinking mode from its focus on the traditional government-led economic growth, which simply emphasizes the maximization of the GDP and the fiscal revenue, to the market-led inclusive growth with the improvement of the people's quality of life as the goal. It shall take advantage of the market's "invisible hand" to adjust the economy, eliminate the backward production capacity, and gradually digest the excess capacity. Originally, the merger and reorganization of enterprises and even exit from the market shall be a necessary link of the market economy, and the problems of the market shall be solved by the methods within the market itself. The focus of government's work should be shifted to the public management and the provision of public services and public goods, so as to provide a good environment for the orderly and healthy development of the market.

#### **4.3 Strengthening the Personnel Training, Improving the Effective Labor of the Labor Force, Making up for the Disappearance of the Demographic Dividends, Increasing the Incomes of the Workers, and Transforming the Economic Well-Being from the Non-equilibrium Type to the Inclusive and Sharing Type**

According to the mode of neoclassical growth with the technological progress, the production function of the economy is as follows:

$$Y = F(AN, K)$$

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In this function, Y represents the output level, A denotes the technical level, N refers to the labor force, K means the capital, and AN is called as the effective labor. It can be seen that the growth of the technological level, like the growth of the labor force, can contribute

to the increase in the output. There are currently three colleges for undergraduates in Jining City, of which two are normal colleges and one is a medical college. The majors, set in those colleges, are far from meeting the needs of the industrial upgrading and structural adjustment in Jining City. For this reason, Jining should vigorously construct such majors as the coals and the chemical industry, the heavy machinery, the textile, the finance and the marketing in relevant colleges and universities, so as to meet the demands for the technical and management talents for the development of these enterprises, make up for the adverse impacts of insufficient labor supply for the enterprises' development, and cultivate senior talents for the industrial upgrading in Jining. At the same time, in the case of the gradual disappearance of the demographic dividends, increasing the effective outputs of the labor force can promote the gradual increase of the workers' wages and make up for the decline in the quantity of the labor force with the growth of the technological level, so that the cost of the effective labor force shall fall back rather than rise, and the social workers' well-being shall be increased.

#### **4.4 The Development of the Modern Service Industry, and Stimulating the Upgrading of the Overall Industrial Structure of Jining City**

As a famous cultural tourist attraction in China, Jining City should take efforts to exert its own resource advantages and characteristics, and take the opening of the Beijing-Shanghai high-speed railway as an opportunity to accelerate the development of its tourist industry. At the same time, it should use its geographical advantages to develop the transportation of goods, the trade circulation, the warehousing, the exhibition and other productive services, while actively developing the high value-added industries in emergence with the excellent market prospects, the intensive knowledge and the wide coverage, such as education, finance, communication and information consulting, so as to promote the development of the tertiary industry in Jining to a high level [4].

## **5 Conclusion**

The technological revolution, based on the big data, has exerted a huge impact on people's work and life styles. Currently, China has to simultaneously deal with the slowdown in economic growth, make difficult structural adjustments, and absorb the effects of previous economic stimulus policies, namely "the three-stage superposition". Using big data technology to analyze and mine various indicators of economic development, using neural network technology to sort out massive data, explore the evolution trend of different indicators, analyze the relationship between them, and find that resource-based cities are facing difficulties such as falling energy prices, excess capacity in the early stage and declining profits in traditional industries. By establishing a neoclassical growth model to analyze the economic transformation path of resource-based cities, and using data visualization technology to show the decisive role of market allocation of resources, it is considered that only by putting structural adjustment in a more prominent position, realizing the transformation of economic development mode from demand management to supply management, taking practical and effective measures to encourage innovation, strengthen talent training and develop the tertiary industry, Only by driving the overall

upgrading of industrial structure can we realize the economic transformation of resource-based cities.

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