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RESEARCH ON COORDINATED DEVELOPMENT OF SCIENTIFIC AND TECHNOLOGICAL INNOVATION, ECONOMIC DEVELOPMENT AND ECOLOGICAL ENVIRONMENT

ИССЛЕДОВАНИЯ ПО СКООРДИНИРОВАННОМУ РАЗВИТИЮ НАУЧНО-ТЕХНИЧЕСКИХ ИННОВАЦИЙ, ЭКОНОМИЧЕСКОГО РАЗВИТИЯ И ЭКОЛОГИЧЕСКОЙ СРЕДЫ

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Abstract. China's economic development has made remarkable achievements, but in the process of rapid economic development, ecological environment has suffered serious damage, at the same time, in recent years, China's economic development is facing increasing downward pressure, economic development into the new normal, be badly in need of adjustment of industrial structure, production power faces to innovation drive, China has made improving its capacity for independent innovation and building an innovative country the core of its national development strategy. Therefore, in the new historical period, the study of the relationship between scientific and technological innovation, economic development and ecological environment is of great practical significance for

avoiding the deterioration of ecological environment caused by economic development and giving full play to scientific and technological innovation in driving economic development, improving the efficiency of economic development and enhancing the sustainability of economic development.

Аннотация. Экономическое развитие Китая добилось значительных успехов, но в процессе быстрого экономического развития экологическая среда понесла серьезный ущерб, в то же время, в последние годы экономическое развитие Китая сталкивается с растущим понижательным давлением, экономическое развитие переходит в новую норму, остро нуждается в корректировке промышленной структуры В условиях, когда производственная мощь сталкивается с инновационным стремлением, Китай сделал повышение своего потенциала в области независимых инноваций и построение инновационной страны основой своей национальной стратегии развития. Поэтому в новый исторический период изучение взаимосвязи между научно-техническими инновациями, экономическим развитием и экологической средой имеет большое практическое значение для предотвращения ухудшения экологической среды, вызванного экономическим развитием, и обеспечения полной отдачи от научно-технических инноваций в стимулировании экономического развития, повышения эффективности экономического развития

Key words: scientific and technological innovation, economic development, ecological environment

Ключевые слова: научно-технические инновации, экономическое развитие, экологическая среда

Introduction

China's economy has entered a stage of high-quality development, and its economic development model has shifted from quantitative to qualitative. Scientific and technological innovation has gradually become the main driving force for economic and social development. Since 1978, 30 years of reform and

opening-up, China's economic development by leaps and bounds, people's living standards increasing quickly, the total economic development has been located in the world, but the quality of economic development is not high, the rapid development of economy also brings contradiction growing population, resources, environment, China's economic development into a historical stage of the overall transformation, This is manifested in the new normal of slowing growth rate, structural adjustment, and transformation of economic development from factor and investment-driven to innovation-driven. Therefore, in the new historical period, it is of great significance to study the relationship between scientific and technological innovation, economic development and ecological environment, and to analyze how to coordinate scientific and technological innovation and ecological environment under the guidance of scientific and sustainable development concept, so as to promote the sustainable development of economy and build a new ecological civilization society.

Methods

2.1 Scientific and technological innovation

The concept of "innovation" first appeared in J. A. Schumpeter's theory of Economic Development (1911). In the book, author Schumpeter pointed out that "innovation" is the reintegration of factors and conditions of production, and the introduction of new combinations into the production system. [1]The concept of technological innovation can be traced back to Adam Smith (1776) in The Wealth of Nations. He pointed out that "the improvement of productivity mainly depends on the improvement of labor force and the improvement of machinery used by workers", and proposed the technological progress that influences economic growth in addition to capital and manpower. [2]This paper holds that scientific and technological innovation is the general term of original scientific research and technological innovation, which refers to the process of creating and applying new knowledge, new technology and new process, adopting new production mode and management mode, developing new products, improving product quality and

providing new services. Scientific and technological innovation can be divided into three types: knowledge innovation, technology innovation and management innovation led by modern science and technology.

2.2 Economic Development

Economic development theory is the eternal subject of economic research, Lucas (1988) said,Once one starts to think about them, it is hard to think about anything else. [3]In the early western economic works, there was no clear distinction between "economic growth" and "economic development". Lloyd G·Keynolds (1977) points out in The Ideal and Reality of Economic Development that "growth And development can be used interchangeably.[4]Economic development is the process in which a country or region moves towards the modernization of its economy and social life. Simply speaking, it refers to the increase of social wealth in a region, that is, the total amount of social products, which is economic growth. This paper thinks that economic development should include the increase of economic aggregate, the optimization of economic structure and the improvement of ecological benefits and other aspects of economic quality improvement.

2.3 Ecological Environment

Ecology is the state in which living things exist and develop under specific social and natural conditions. Ecological environment is short for "environment composed of ecological relations". Ecological environment refers to the quantity and quality of water resources, land resources, biological resources and climate resources that affect human survival and development, and is a composite ecosystem related to the sustainable development of society and economy.

3.1 Scientific and technological innovation provides driving force for economic development, while economic development provides material guarantee for scientific and technological innovation.

Science and technology are the primary productive forces. The level of scientific and technological innovation of a country largely determines the basic outlook of

its economic and social development. Scientific and technological innovation promotes economic development by promoting industrial renewal, the formation of new markets and the development of industrial clusters. The driving role of economic development is mainly reflected in optimizing industrial structure, promoting the transformation and upgrading of economic development mode and enhancing the power of economic development.

At the same time, with the development of economy, the economic development mode continues to be optimized, the investment in scientific and technological innovation increases, and the capital, information and talents required for innovation increase, thus forming a good innovation environment. The enhancement of investment capacity, technological progress, human capital and knowledge accumulation to a certain extent promote the emergence of scientific and technological innovation, to provide material security for scientific and technological innovation.

General Secretary Xi Jinping has stressed that "promoting the integration of scientific and technological innovation with the economy is the focus of reform and innovation, which is also where China lags far behind developed countries" and "promoting the deep integration of scientific and technological development with economic and social development, opening up a channel from strong science and technology to strong industry, strong economy, and strong country".[5] The starting point and foothold of scientific and technological innovation research is how to deeply integrate scientific and technological innovation with economic and social development, so as to better promote economic development.

3.2 Economic development needs a good ecological environment, which is the basis and premise of human survival and development. A good ecological environment is conducive to economic development.

Economic development is the foundation of a country, especially in developing countries. Ecological environment is the guarantee of economic development. Environmental protection is to maintain the normal operation of productive forces.

A good eco-environmental circulation system means that the environmental resources serve as the guarantee of economic development and at the same time do a good job in the management of environmental resource circulation so that the resource regeneration capacity is greater than the demand of economic growth.

If this good environment circulation system of operation the destruction, economic development at the same time not to do a good job of environmental protection, makes the environment resources suffer from pollution, damage, cause environmental self-purification capacity, lose caused by environmental resources dried up, and eventually will in turn affect the development of economy, the formation of the shackles of economic development.

Economy is the condition guarantee of ecological environment protection, and ecological environment is the material basis of economic development. Without the supply of ecological environment resources, economic development is out of the question. And without the source of economic capital, the protection of ecological environment and resources cannot be further improved, because to some extent, the two are complementary and indispensable.

3.3 Scientific and technological innovation provides technical support for ecological environment governance, while strict environmental protection policies and technologies can encourage enterprises to carry out technological innovation.

On the one hand, science and technology provide necessary technical support for the improvement of the ecological environment, improve the efficiency of resource utilization, and play an important role in resource conservation and pollution control. The progress of science and technology is conducive to deepening people's understanding of the relationship between man and nature. Science and technology have the obvious advantages of fast speed and high efficiency in the treatment of environmental pollution, and play an important role in sewage treatment and air purification.

On the other hand, the improvement of ecological environment can provide the premise and foundation for scientific and technological innovation, and the

strict environmental protection policy can stimulate enterprises to carry out technological innovation and enhance their competitiveness.

Results and discussion

Analysis of the current situation of scientific and technological innovation

This paper mainly analyzes some representative indexes of Scientific and technological innovation in China. In addition, due to regional differences in the development of scientific and technological innovation, the status quo of scientific and technological innovation is also analyzed from the eastern, central and western regions.

Number of patents granted

As can be seen from Table 1, there is a big difference between the whole country and different regions. The difference of invention patents and design patents between the east and the central and western regions is large, while the difference of invention patents between the central and western regions is small. It shows that there is a big gap between the market and technological innovation ability of enterprises in different regions of China, so we should pay more attention to improving the market innovation ability of enterprises in central and western China. As can be seen from Table 2, both the number of patent authorization and the number of application acceptance in China show an increasing trend, indicating that the capability of scientific and technological innovation in China and all regions is constantly improving. The number of patent authorization in the central and western regions is similar, but both are far lower than that in the eastern regions. Therefore, the central and western regions need to vigorously cultivate scientific research talents, improve the scientific research level of personnel in innovative enterprises, and draw on the development experience of the eastern regions to narrow the gap.

Table1. Distribution of Three Types of Patent Applications by Region (2011)

Units: Piece

Region	A combined	Utility model	Appearance design
The national	883861	405086	366428
The eastern region	673008	290333	303981
The central region	114719	64011	35506
In the western region	76200	40416	23856

Source: China Statistical Yearbook of Science and Technology

Table2 2012-2021 Number of domestic patents authorized, accepted and their proportion

Time	Number of domestic patent applications accepted (a)	The number of domestic patents granted (a)	Proportion of Domestic patent authorization in acceptance (%)
2021		4451000	
2020	5016030	3520901	70%
2019	4195104	2474406	59%
2018	4121475	2319209	56%
2017	3513200	1705100	49%
2016	3281200	1611900	49%
2015	2616700	1578200	60%
2014	2186500	1191600	54%
2013	2209600	1210200	55%
2012	1912151	1163226	61%

Sales revenue of new products

The bar chart in Figure 1 shows the sales revenue of new products of the high-tech industry in China. In 2012, the sales revenue of new products of the high-tech industry was 25,5710,383,000 yuan, and in 2020, the sales revenue of new products of the high-tech industry was 68,549,144,460 yuan, an increase of 2.68 times. It shows that the system and mechanism of transformation of scientific and technological achievements in China has improved the income-generating rate of

Scientific and technological achievements in each region, and thus increased the sales income of new products.

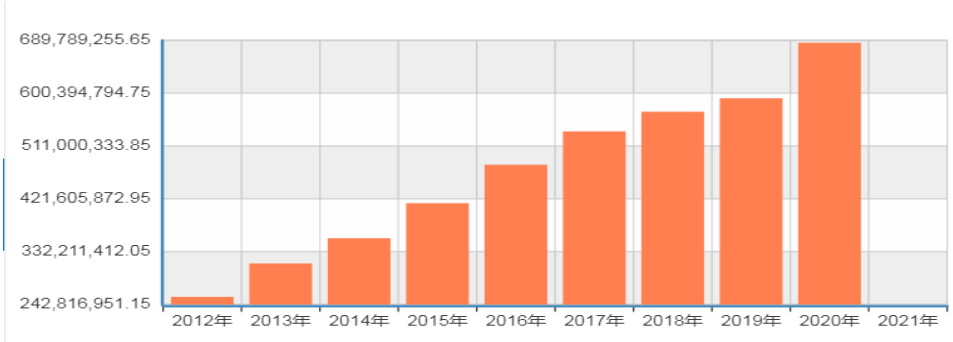

Figure 1. Sales revenue of new products in high-tech industry (ten thousand yuan)

4.1.3 Turnover of technology market

Technology market promotes the combination of science and technology and economy, and promotes the transformation of technological products from research results to production factors The necessary way. In recent years, with the rapid development of technical services and development, China's technology market turnover is stable Step growth, as shown in Figure 2, from 643.707 billion yuan in 2012 to 2,825.151 billion yuan in 2020, an increase of 4.39 times. However, there is serious regional development imbalance in China's technology market. The turnover of technology market in eastern China continues to expand, while the total turnover of technology market in central and western China is less.

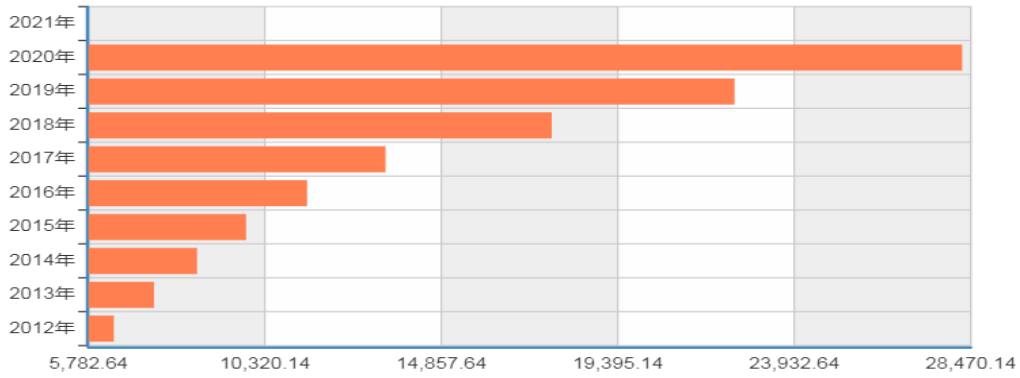

Figure 2. Technology Market Turnover (100 million Yuan)

4.2 Analysis of current situation of economic development

This section analyzes economic development from three aspects. One is economic aggregate, i.e. gross domestic product The process of continuous improvement. Second, the change of industrial structure, that is, the change of the proportion of the three industries. Third, economic quality.That's what happens to people's living standards.

4.2.1 Economic aggregate

It can be seen from Figure 3 that, under the influence of severe environmental conditions and industrial structure transformation, the economic growth of China and all regions slowed down, but the economic aggregate grew steadily. The GDP

of China and all regions grew steadily, from 1.902.47 trillion yuan in 2012 to 4.026955 trillion yuan in 2021. The economic development speed of the east and the west is different, and with the increase of years, the gap between regional economic aggregate widens. The backward regions should actively change their economic development ideas and strive to find new economic growth points to achieve economic growth.

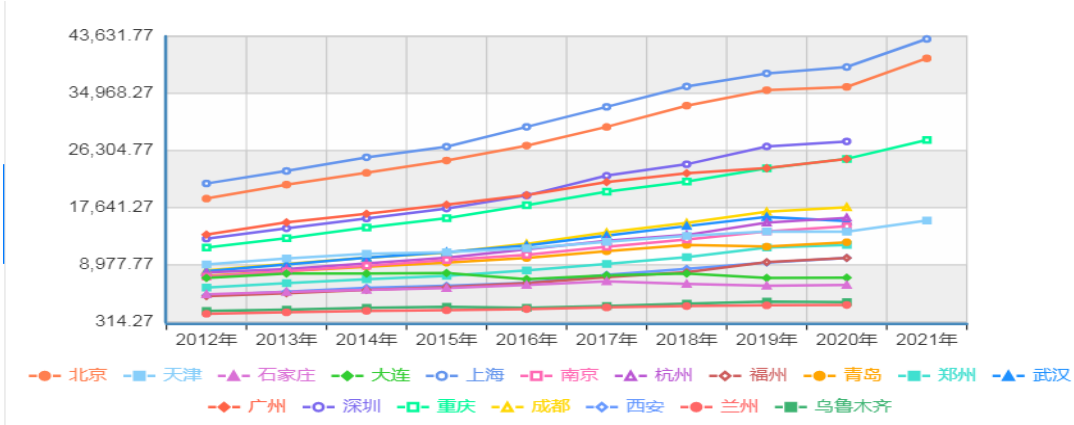

Figure 3. GDP

4.2.2 Change of industrial structure

Industrial structure is an important indicator to measure the state of economic development. It is generally believed that the stronger a country's economic strength is,The higher the proportion of tertiary industry. It can be seen from Table 3 that although the total value of China's primary and secondary industries is increasing year by year, it is still in the The proportion of the total value of the three industries declined year by year. With the rapid development of business, finance and other services, third While the total value of industry is increasing, its proportion is also increasing year by year, and far exceeds the proportion of primary industry.

Table 3. Total value and proportion of the three industries

time	GDP (100 million yuan)	Added value of the secondary Industry (100 million Yuan)	Value-added of tertiary Industry (100 million Yuan)	Added value of primary Industry (%)	Value added of the secondary Industry (%)	Value-added of tertiary Industry (%)
2021	1143669.7	450904.5	609679.7	7.3	39.4	53.3
2020	1013567	383562.4	551973.7	7.7	37.8	54.5
2019	986515.2	380670.6	535371	7.1	38.6	54.3
2018	919281.1	364835.2	489700.8	7	39.7	53.3
2017	832035.9	331580.5	438355.9	7.5	39.9	52.7
2016	746395.1	295427.8	390828.1	8.1	39.6	52.4
2015	688858.2	281338.9	349744.7	8.4	40.8	50.8
2014	643563.1	277282.8	310654	8.6	43.1	48.3
2013	592963.2	261951.6	277983.5	8.9	44.2	46.9
2012	538580	244639.1	244856.2	9.1	45.4	45.5

4.2.3 Economic quality

From 2012 to 2020, the quality of life of people in China and all regions has been greatly improved. As shown in Figure 4, the average wage of urban employees in China has increased from 33,784 yuan in 2012 to 68,590 Yuan in 2020, an increase of 2.03 times. Thanks to the implementation of China's rural revitalization strategy and other policies, the economic quality has been guaranteed, and the resources and environment have also been improved to some extent.

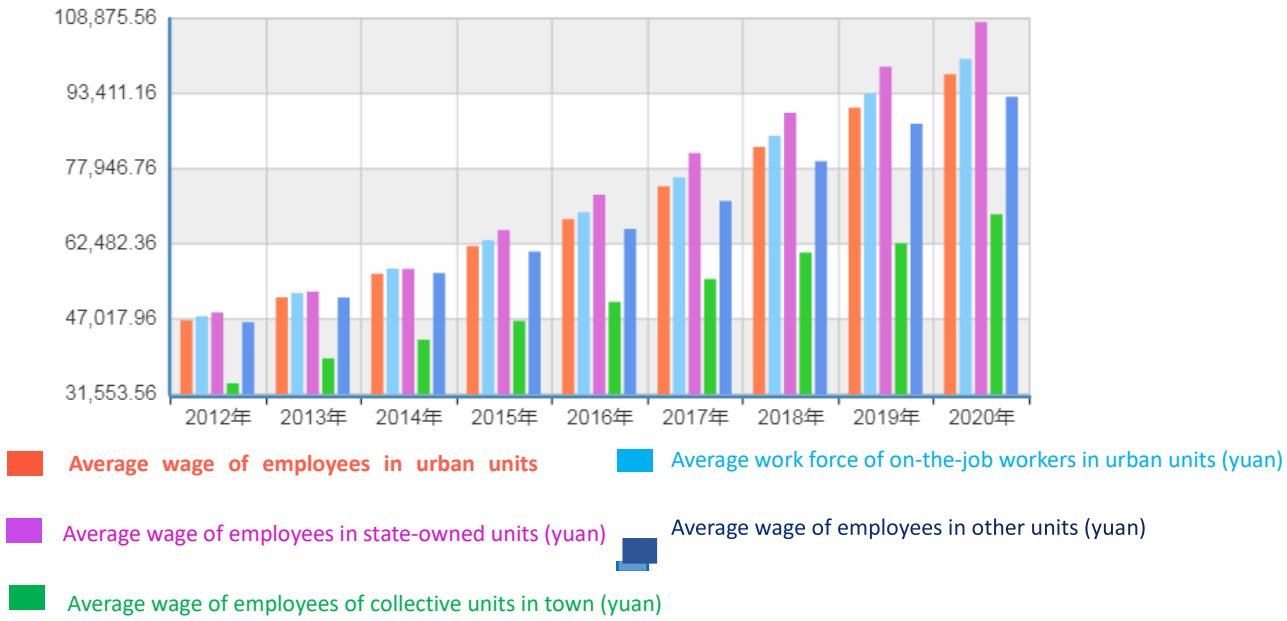

Figure 4.The average wage of urban employees in China

4.3 Ecological environment

This paper mainly analyzes the status of ecological environment from three aspects, namely, investment in environmental pollution control, pollutant discharge and urban household garbage classification and harmless treatment rate. Details are as follows:

4.3.1Investment in environmental pollution control

As shown in Figure 5, China's total investment in environmental pollution control in 2012 was 826.346 billion yuan, and the total investment in environmental pollution control in 2017 was 953.895 billion yuan, an increase of 1.15 times in five years. It can be seen that the Chinese government has made great investment in environmental governance and is committed to improving the ecological environment.

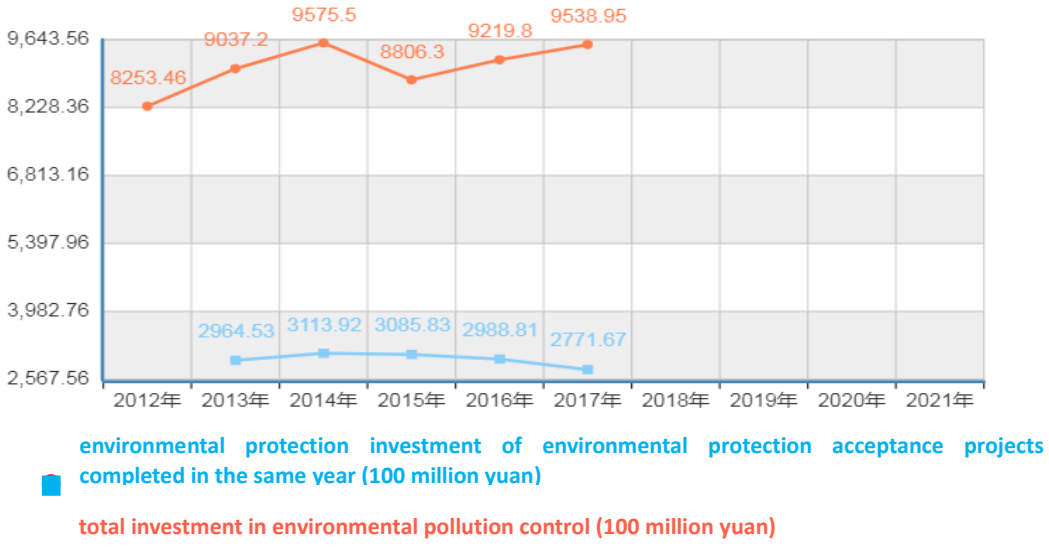

Figure 5.Total investment in environmental pollution control

4.3.2 Pollutant emissions

Sulfur dioxide emissions decreased significantly, as shown in Figure 6, from 21.180 million tons in 2012 to 3.182 million tons in 2020, a reduction of 85%. Nitrogen oxide emissions also decreased from 23.3776 million tons in 2012 to 10.196 million tons in 2020, a reduction of 56%. Particulate emissions also decreased 62 percent from 16.080,100 million tons in 2016 to 6.114 million tons in

2020, indicating that pollutant emissions have been well controlled and the ecological environment has improved.

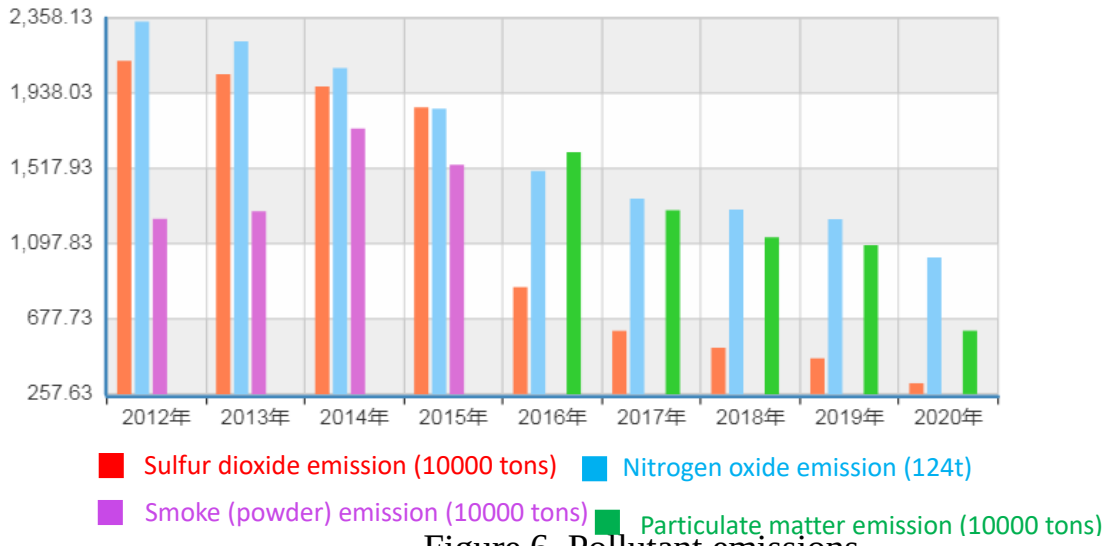

Figure 6. Pollutant emissions

4.3.3 Urban household garbage classification and harmless treatment rate

As can be seen from Table 4, from 2012 to 2020, the number of harmless treatment plants increased significantly, from 701 in 2012 to 1287 in 2020. The harmless treatment capacity of domestic garbage increased by nearly 4 times in 9 years, and the harmless treatment capacity of domestic garbage and fecal domestic garbage increased greatly. The rate of harmless treatment of domestic waste increased by 15% in 9 years, which shows that China has invested more in ecological environment management and the ecological environment has been greatly improved.

Table4.Urban household garbage classification and harmless treatment rate

Indicators	2020	2019	2018	2017	2016	2015	2014	2013	2012
Number of harmless treatment plants (unit)	1287	1183	1091	1013	940	890	818	765	701
Number of domestic waste sanitary landfill harmless treatment plants (unit)	644	652	663	654	657	640	604	580	540
Number of domestic waste composting harmless treatment plants (unit)									
Number of domestic waste incineration harmless treatment plants (unit)	463	389	331	286	249	220	188	166	138
Harmless treatment capacity of household garbage (ton/day)	963460	869875	766195	679889	621351	576894	533455	492300	446268
Sanitary landfill harmless treatment capacity of domestic waste (ton/day)	337848	367013	373498	360524	350103	344135	335316	322782	310927
Garbage incineration harmless treatment capacity (ton/day)	567804	456499	364595	298062	255850	219080	185957	158488	122649
Harmless disposal capacity of household garbage (ten thousand tons)	23452.3	24012.8	22565.4	21034.2	19673.8	18013	16393.7	15394	14489.5
Sanitary landfill harmless disposal volume of Domestic waste (ten thousand tons)	7771.5	10948	11706	12037.6	11866.4	11483.1	10744.3	10492.7	10512.5
Harmless disposal capacity of household garbage incineration (ten thousand tons)	14607.6	12174.2	10184.9	8463.3	7378.4	6175.5	5329.9	4633.7	3584.1
Harmless treatment capacity of feces (ten thousand tons)					647.1	673.7	692	677.8	801.4
Harmless treatment rate of household garbage (%)	99.7	99.2	99	97.7	96.6	94.1	91.8	89.3	84.8

Conclusion

From whole to our country, and from the eastern, central and western three areas of science and technology innovation, economic development and ecological environment present situation analysis can be found, because of the differences in the levels of regional economic development and resources don't match, China's science and technology innovation, economic development and ecological environment at the regional level exists heterogeneity, and the three mechanisms and influence also exists heterogeneity, Regional scientific and technological innovation and unbalanced economic development are one of the urgent problems to be solved in China.

Based on this, the paper puts forward relevant policy suggestions from the national perspective and regional perspective as follows:

First, from the national level of science and technology innovation policy guidance, improve the scientific and technological innovation system, strengthening regional cooperation between science and technology innovation Strengthening regional cooperation is the necessary choice, can promote the regional common development, to solve the common problems in the development of science and technology innovation, the central and western regions under the national policy support, cultivate innovative talents, Regions with high scientific and technological innovation capacity should drive the development of other

regions to promote the flow of talents and the sharing of science and technology. The state should guide the effective allocation of scientific and technological innovation among the three regions and promote the coordinated development among the three regions.

Second, due to the regional heterogeneity of China's economic development level, each region should formulate supporting policies for scientific and technological innovation and economic development according to relevant national policies and considering its own development characteristics and development level, optimize the environment for scientific and technological innovation and promote the development of local scientific and technological innovation. At the same time, backward regions should actively change their economic development ideas and strive to find new economic growth points to achieve economic growth.

Third, we should attach importance to the coordinated development of scientific and technological innovation, economic development and the ecological environment , Science and technology innovation is beneficial to speeding up China's economic transformation, technological innovation, economic development and ecological environment, three connect with each other, restrict each other, realize the coordinated development, only three to solve China's economic development in the process of economic development power shortage and ecological environment deterioration, to achieve sound and rapid economic development, science and technology innovation ability, The goal of improving the ecological environment is to achieve high-quality development of China's economy.

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