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Chinese oil industry modernization system construction path choice

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Abstract

With the rapid development of national economy, China's energy demand presents a rapid growth trend. As the representative of traditional energy, petroleum resources still play an important role in the case of other energy replacement technology is not mature. Therefore, it is very important to accelerate the development of petroleum industry and establish a modern petroleum industry system. This paper discusses the construction of modern petroleum industry system and analyzes the existing problems in petroleum industry and their causes. This paper puts forward some suggestions to perfect the modern petroleum industry system, which is of great significance in improving the exploitation and utilization efficiency of petroleum resources and promoting the sustainable development of economy and society.

Keywords: The oil industry; Modernization; System construction; Development path

1. INTRODUCTION

With the continuous development of global economy and population growth, the demand for energy resources is also increasing. As one of the most important sources of energy, the oil industry plays a vital role in the world economy. However, there are many problems in the petroleum industry at present, such as low efficiency of resource exploitation, serious environmental pollution, and difficulty of safe production. These problems seriously restrict the sustainable development of petroleum industry and the development of national economy. Therefore, the modernization construction of petroleum industry system has become an urgent problem to be solved. This paper aims to analyze the problems existing in the petroleum industry and their causes and put forward some suggestions to improve the construction of the petroleum industry modernization system. First of all, from the current situation of the petroleum industry and the challenges faced, we will discuss the modernization of the technological progress and management system of the petroleum industry, introduce modern ideas and methods, and strengthen the overall strength of the petroleum industry. Secondly, we will combine the characteristics of the petroleum industry in China, from the aspects of policies and regulations, technological innovation, market competition, and so on, and put forward some concrete suggestions to improve.

2. Present situation of Chinese petroleum industry system construction

2.1. Chinese oil production and reserves steadily increase

The petroleum industry of China is in the stage of rapid development and is one of the largest petroleum-consuming countries in the world. In recent years, China's domestic oil reserves and production have shown a steady growth trend. According to the latest data, China's domestic oil reserves have reached more than 25 billion tons, mainly distributed in Bohai Bay, Songliao, Tarim, Ordos, Junggar, Pearl River Estuary, Qaidam and eight basins of the South China Sea shelf,¹ the world's tenth oil reserves, the total oil production is more than 500 million tons.

In April 2023, China Petroleum Enterprises Association, University of International Business and Economics, China University of Petroleum (Beijing), and Southwest Petroleum University jointly issued the Blue Book of Analysis and Prospect Report of China's Oil and Gas Industry Development (2022-2023) in Beijing. It was pointed out that in 2022, China's new proved geological reserves of petroleum exceeded 1.4 billion tons. China consumed 345 million tons of refined oil products, up 0.9 percent year on year. China imported 508.28 million tons of crude oil, down 0.9 percent



year on year, and its dependence on foreign oil dropped to 71.2 percent.²

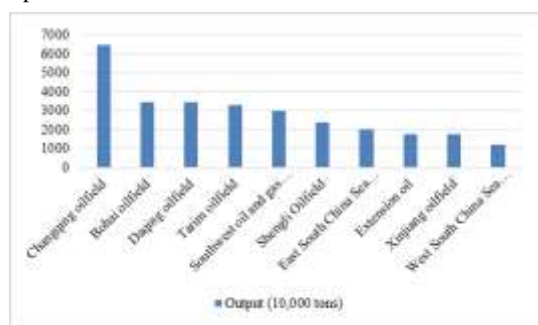


Figure 2.1 Production Ranking of China's Oil and gas fields in 2022 (Top 10) Source: Petroleum Link

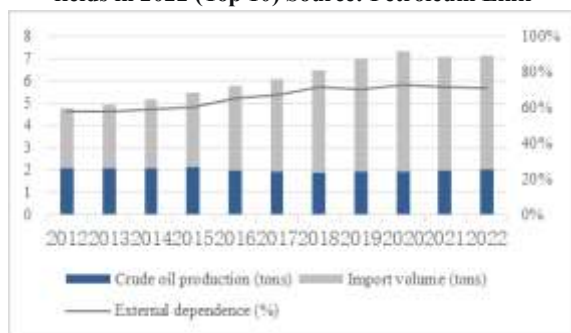


Figure 2.2 China's crude oil production, import volume, and external dependence data sources: China Economic Research Institute; National Bureau of Statistics

2.2. The domestic petroleum industry has such problems as backward technology, unitary industrial structure, and great pressure on environmental protection

Chinese oil industry technology is relatively backward. Oil is one of the most important energy sources in modern industrialized society. China began to explore and explore oil resources since the 1950s. After going through the process of exploration and development for many years, China has now become a state with a huge oil industry.³ However, from a technical point of view, Chinese petroleum industry still has some backwardness.

System structure of Chinese oil industry is single. The petroleum industry is one of the important pillars of Chinese national economy, but there is still a single problem in the structure of Chinese petroleum industry at present. It is mainly manifested in the few kinds of petroleum products, excessive dependence on traditional heavy petroleum and some oil fields have entered the middle and late period and are difficult to exploit. These problems not only limit the sustainable development of the oil industry but also restrict the upgrading of the entire economic structure.

Environmental protection pressure is high. The oil industry has long existed the problems of environmental pollution and energy waste, which have caused great impact on the environment while pursuing economic benefits.

Contradiction between supply and demand of resources. With the constant increase of Chinese petroleum demand, the petroleum industry faces a new challenge. Although total oil resource is abundant in China, there is a certain contradiction in supply and demand structure.

2.3. Competition in the international market is fierce, so domestic enterprises need to improve their competitiveness

The petroleum industry is one of the most competitive industries in the world, and domestic petroleum enterprises are also facing fierce market competition. Under the background of globalization, informatization, and social and economic development, petroleum enterprises need to realize more strategic layout, improve their core competitiveness, and actively explore the international market, in order to gain greater advantages in market competition.

The reality of increasing competition. The oil industry is facing increasingly fierce market competition all over the world. Many countries attach great importance to the protection and utilization of their own oil resources and import oil raw materials or refined oil products from all over the world. This means that oil companies must have an edge in quality, cost, and so on in order to compete in the market.

Petroleum enterprises are faced with increasingly fierce market competition and huge challenges. How to improve their core competitiveness, actively introduce new technologies and new ideas to maintain market competitive advantages, strengthen communication with international counterparts, implement accurate positioning, and implement excellent strategies are all issues that enterprises need to think and explore.

2.4. The modernization of petroleum industry is the inevitable choice to conform to the trend of market development

With the constant changes in the market, many new trends have emerged in the oil industry. In this context, the modernization of petroleum industry has become a problem for us to think and explore. The modernization of petroleum industry is the inevitable choice to conform to the trend of market development and the key to achieve sustainable development and competitive advantage.

Information technology makes the oil industry more intelligent. The rapid development of modern science and technology makes the petroleum industry more intelligent, automatic, and digital. Through the Internet of Things, big data, artificial intelligence, and other technologies, oil companies can monitor all aspects of production in real-time, improve decision-making efficiency and resource utilization efficiency, further reduce costs and improve safety.

Green and low-carbon has become the new direction of development. The future development of the oil industry will pay more attention to green and low-carbon, and promote the adjustment of energy structure and environmental protection. This means that petroleum enterprises need to accelerate transformation and upgrading, strengthen the research and

development of clean and new energy, constantly eliminate outdated equipment and processes, expand product application areas, and achieve sustainable development.

Industrial chain coordination is essential for production and sales. In modern economic life, the expanding oil industry has gradually formed an industrial chain, including oil exploration, exploitation, processing, transportation, sales, and other links. It is one of the indispensable contents of the modernization of petroleum industry to expand the industrial chain, improve the synergistic effect, deeply integrate all links, and realize the effective use of resources better.

The modernization of petroleum industry is an important direction to conform to the trend of market development and the needs of enterprise development. It needs to carry out transformation and upgrading, keep pace with The Times, strengthen technological innovation and information construction. At the same time, oil companies should also strengthen coordination and cooperation, integrate resource advantages, and achieve win-win results by means of complementary advantages and interconnection. Through continuous self-correction and forward-looking reform, the oil industry can achieve healthy, rapid, sustainable, and long-term development and contribute more value to the economic and social development.

3. Analysis of the construction environment of Chinese petroleum industry system

3.1. Policy environment

In terms of resource management system, in March 1986, the Standing Committee of the Sixth National People's Congress passed the "Mineral Resources Law of the People's Republic of China", proposed that Chinese implements the state-owned mineral resources property right system, the state implements the exploration and production permit system for petroleum resources. ⁴ China National Petroleum Corporation and other large state-owned petroleum enterprises, as well as China National Petroleum and Natural Gas Network, will form a mature regulatory system to be responsible for the planning, production, supply, and market of the oil and gas industry. In terms of environmental protection, The State Council Information Office issued a white paper titled "China's Energy Development in the New Era" in December 2020, pointing out that China needs to strengthen environmental protection supervision in the process of oil and gas development and promote the construction and application of energy conservation, emission reduction, cleaner production, and green technology in the process of oil and gas exploration, development and utilization. In terms of market reform, in March 2021, the Fourth Session of the 13th National People's Congress voted to adopt the 14th Five-Year Plan for National Economic and Social Development of the People's Republic of China and the Outline of Long-term Goals for 2035, which allows orderly access to the oil exploration and development market, focuses on key core technologies in oil exploration and development, and accelerates the utilization of deep-sea

and deep oil resources. In general, the policy environment for the construction of China's petroleum industry system is constantly improving, from resource management to market-oriented reform, from environmental protection to technological innovation, all of which provide strong support for the sustainable development of the petroleum industry.

3.2. Economic environment

Oil is one of the dominant products in the global energy market in terms of market size and demand. According to the latest OPEC data (December report), the current global crude oil demand is around 98 million barrels per day, and China's oil demand ranks second in the world, accounting for about 15% of the global total. With the rapid development of Chinese economy and the acceleration of urbanization, the demand for oil and natural gas for Chinese industry and transportation continues to grow. In recent years, the Chinese government has introduced a series of policies and measures to promote the upgrading, transformation, and upgrading of the petroleum industry, encouraging enterprises to strengthen technological innovation and resource integration, improve production efficiency and product-added value. These measures have effectively promoted the continuous expansion and growth of the market size and demand of the petroleum industry.

In terms of price and tax policy, the price and tax policy of the petroleum industry has a crucial impact on the development of the industry and social economy. In China, the pricing of the petroleum products is mainly adjusted by the National Development and Reform Commission and other relevant departments using the mechanism of "Wholesale price adjustment + Market Adjustment". In addition, China has also implemented a mechanism that combines "guarantee" and "adjustment" of oil price. That is, when the global oil price rises, the state can implement a number of policy controls on oil price to ensure the normal life of the people and maintain the stability of economic operation, so as to reduce the negative impact on society. ⁵ In terms of tax policy, Chinese petroleum industry pays tax strictly, including resources tax, income tax, import tariff, consumption tax, and so on. At the same time, the state is also gradually promoting the demonstration application of oil alternative energy and providing certain incentive measures for the development of clean energy, such as preferential tax policies for new energy vehicles, solar energy, wind energy, and other fields, in order to promote the sustainable development of the industry. China's oil industry carries out market-oriented reform, price and tax policies are gradually rationalized, and market vitality is gradually released.

In terms of competition pattern, the global oil industry competition pattern is complicated, mainly affected by political, economic, and geographical factors. Major domestic oil producers, including Sinopec, petro china, and CNOOC, are engaged in fierce market competition among themselves, but also need to deal with multiple challenges such as fluctuations in international crude oil prices, environmental protection policies, and breakthroughs in new energy

technologies. In order to cope with these challenges, domestic oil production enterprises continue to strengthen technological innovation and resource integration, improve the ability to control oil reserves and the efficiency of oilfield development, accelerate the transformation and upgrading of clean energy, and actively arrange the upstream and downstream areas of the oil industry chain, build the layout of the whole industry chain, and improve the core competitiveness of enterprises.

The economic environment of oil and gas industry in China is full of opportunities and challenges. Through policy guidance and industrial transformation, it is expected to further improve the economic benefits and development quality of the oil and gas industry.

3.3 Financial environment

The financial environment of petroleum industry mainly includes financing channels, financial products and services, and risk management.

In terms of financing channels, oil enterprises can raise funds through bank loans, bond issuance, equity financing, and other ways. In addition, oil futures and derivatives markets are also important tools for oil companies to raise funds and hedge risks. ⁶

In terms of financial products and services, petroleum enterprises can rely on rich resources and asset characteristics, adopt a variety of financial instruments such as pledge financing, bond issuance, structured financial products for financing, and risk management. At the same time, petroleum enterprises can also make use of the products and services provided by domestic and foreign financial institutions, such as financial consulting, financing consulting, risk management, and other professional services, so as to enhance the operation effect.

In terms of risk management, petroleum enterprises are faced with market risk, price fluctuation risk, policy change risk, and so on. In order to deal with these risks effectively, petroleum enterprises need to design and implement scientific risk management system, establish sound internal control mechanism and risk management system. In addition, oil enterprises can also use financial derivatives and other instruments to hedge and prevent risks.

The financial environment of China's oil industry is relatively complete, providing enterprises with diversified financing services and risk management means through various financial instruments and channels. In the future, with the deepening of oil and gas marketization and green transformation, financial service institutions will pay more attention to corporate social responsibility and environmental protection capabilities, and the demand for green financial products will continue to grow.

3.4 Technical Environment

In terms of exploration and development technologies, China's petroleum exploration and development technologies continue to improve, mainly including 3D seismic exploration technology, hydraulic fracturing technology, efficient

downhole extraction technology, and clean energy development technology. Great progress has been made in deep-sea oil and gas exploration, shale gas, coal bed methane, and other new energy exploration and utilization. The exploration and development technology of the petroleum industry needs continuous innovation and progress to meet the growing market demand and provide strong support for the sustainable development of the industry. ⁷

In terms of oil production technology, the petroleum enterprises of China adopt new oil production techniques, such as horizontal Wells, multistage hydraulic fracturing, and enhanced oil recovery, which increase production efficiency and utilization rate. At the same time, strengthening environmental protection measures to achieve sustainable development can not only ensure the safety and effectiveness of oil production but also protect the sustainable use of environmental resources. ⁸

In terms of environmental protection technology, Chinese petroleum industry actively promotes clean production, green technology, energy saving and emission reduction, and other environmental protection technologies, which reduces the impact of the petroleum industry on the environment. It has made certain achievements and breakthroughs in oil pollution control technology and low-carbon clean production technology, which can realize the utilization of waste resources, improve the utilization efficiency of resources, and realize the harmonious coexistence of ecology and oil development in ecological construction and protection. ⁹

In terms of intelligent technology, Chinese petroleum enterprises accelerate intelligent transformation, apply information technology, artificial intelligence, and other digital technologies, improve the level of automation and digital management. In terms of sensor technology, the sensor detects the temperature, pressure, flow rate, and other information of the oil well, so that the company can timely understand the equipment operating status, production and oil recovery efficiency, and other data information, so as to better adjust the opening of the oil well and ensure the stable improvement of oil production and quality. In terms of big data analysis technology, the big data analysis platform is used to process the massive data generated during the operation of oil Wells, to predict oil production, improve resource utilization efficiency, optimize operating procedures, and formulate optimal emission plans, so as to support enterprises to make scientific and reasonable decisions. In terms of visualization technology, visualization technologies such as virtual reality and augmented reality are used to provide intuitive, three-dimensional, and interactive scene display to help oil field managers intuitively grasp the specific conditions of oil Wells and then make corresponding changes and adjustments. Unmanned aerial vehicles (UAVs) and unmanned vehicles (UAVs) are widely used in exploration, drilling, and delivery systems to improve efficiency and reduce energy consumption and pollution emissions without regard for human safety. ¹⁰

In terms of energy equipment technology, Chinese petroleum enterprises have strengthened the innovation of equipment technology, actively introduced foreign advanced technology, and gradually formed a new type of independently researched and manufactured petroleum equipment.

Chinese petroleum industry technology environment is constantly developing and innovating. With the promotion of green sustainable development concept, Chinese petroleum industry will continue to promote technological innovation and innovation, and realize the balanced development of resource utilization efficiency and environmental friendliness.

4. The construction path of modern system of Chinese oil industry

The construction of the modernization system of the petroleum industry needs to take various factors into account comprehensively to realize industrial transformation and upgrading, market-oriented reform, capital market support, ecological and environmental protection, and international cooperation. The sustainable and healthy development of petroleum industry can only be realized on the basis of pushing forward the reform in all aspects continuously.

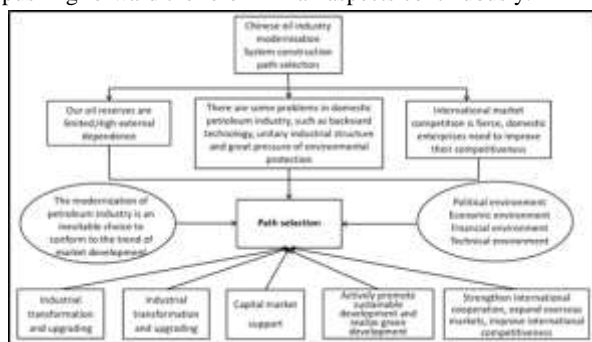


Figure 4-1 Chinese petroleum industry modernization system construction path

4.1. Industrial transformation and upgrading

We should promote industrial innovation and development through technological and management innovation, and continuously improve the efficiency of resource utilization and environmental protection. For example, we should strengthen technological innovation in exploration and mining, research and develop intelligent equipment, and promote the development and utilization of new energy sources.

First, promote non-fossil energy consumption. The Chinese government has strengthened non-fossil energy policies, increased investment in and popularization of clean energy, and adopted a number of supportive policies to encourage enterprises to produce and sell clean energy products. Oil companies can actively participate in the field of new energy, find and develop new industries related to it, and adapt to the changes of energy market.

Second, we will promote scientific and technological innovation. We should improve the level of oil extraction, transportation, and processing technology, improve energy efficiency, and reduce production and operating costs. The

petroleum industry needs to learn from new technologies, innovative management modes, and organizational methods, promote the innovation ability of petroleum enterprises, and improve resource utilization efficiency and scientific and technological content.

Third, improve the petroleum industry restructuring and withdrawal mechanism. We will improve the legal system and standard procedures for enterprise restructuring and mergers and acquisitions, and accelerate the optimization and integration of resources and industrial adjustment. We will set up an enterprise exit mechanism to eliminate the fittest and backwardness and achieve sustainable development by promoting market reforms and strengthening fair competition.

Fourth, attach importance to environmental protection. The oil industry should take an active part in environmental governance and improve the management level of the whole process of oil exploration, transport, processing, and use. We will strengthen efforts to control the active discharge of waste gas, wastewater, and garbage. To achieve low-carbon development by reducing carbon dioxide emissions and limiting greenhouse gas emissions.

4.2. Market-oriented reform

We should introduce market mechanisms to promote reform, foster a level playing field, encourage the development of diverse forms of ownership, and realize global resource allocation and market value.

First, we will promote market-based pricing. The core of oil market reform is to promote the marketization of price formation mechanism. By establishing a market-based oil price formation mechanism, encouraging competition, survival of the fittest, and differentiated pricing, the efficiency of resource allocation and social benefits will be improved.

Second, we will improve market oversight mechanisms. The government should create a fair and competitive market environment, improve the market supervision mechanism, maintain the normal order of the oil market, and crack down on criminals. At the same time, market information release and transparency should be strengthened to enhance the confidence and stability of oil market trading.

Third, we will advance the reform of monopoly enterprises. Many state-owned oil companies formed large monopolies in the past period of the planned economy and struggled to meet market demand, limiting domestic and foreign investment and competitiveness. By deepening reform, we will stimulate the vitality and innovative spirit of enterprises, reduce production and operation costs, and improve their market competitiveness.

Fourth, we will accelerate the development of an energy Internet. With the development of information technology and Internet of Things technology, the construction of energy Internet should be promoted, and the interconnection between clean energy and petroleum fuel should be promoted, so as to optimize the distribution of energy resources and maximize the utilization efficiency.

4.3. Capital market support

Make full use of capital market investment and financing and other financial instruments, attract domestic and foreign high-quality capital to participate in oil projects, optimize equity structure, mergers and acquisitions, and other ways to promote cooperation and integrated development among enterprises.

First, we will advance the reform of listed companies. Oil companies should actively promote the reform of listed companies, realize shareholding transformation, and expand financing channels. By optimizing the corporate governance structure and enhancing the competitiveness of enterprises, more medium- and long-term funds will be attracted to the oil industry.

Second, we will encourage professional investment institutions to enter the market. The government should actively encourage the entry of professional investment institutions into the oil industry, facilitate the financing of enterprises by setting up funds, bonds, and other instruments, promote the participation of investors with a broad vision in the oil industry, and promote the development of the oil capital market.

Third, improve the petroleum investment supervision mechanism. In view of the safety risks and environmental pollution problems existing in the petroleum industry, we should improve the supervision mechanism of petroleum investment, strengthen the supervision and management of petroleum enterprises, and prevent the occurrence of investment risks and environmental pollution problems.

Fourth, we will strengthen government guidance. The government should strengthen the guidance and service support for the petroleum industry, so as to promote the technological innovation and brand image of the petroleum enterprises and enhance the international competitiveness of the enterprises. Strengthen international cooperation and jointly develop resources to provide better guarantee for investment and financing activities of petroleum enterprises.

4.4. Actively promote sustainable development and realize green development

The oil industry should actively respond to the green transformation initiative, regard environmental protection as a top priority development goal, promote technological innovation, and lead the green and low-carbon development of the industry.

First, we will strengthen the formulation of environmental laws, regulations, and standards. On the premise of ensuring the normal production of petroleum enterprises, the government should introduce more perfect environmental laws and standards, so as to supervise the production and operation behaviors of enterprises, improve the environmental awareness of enterprises and strengthen the strength of environmental protection management.

Second, promote the development of low-carbon economy. Low-carbon economy is the inevitable trend of future economic development. The government should encourage oil

enterprises to increase the proportion of development and utilization of clean energy, promote advanced energy-saving technologies, and reduce the environmental impact of oil by reaching the targets of carbon dioxide emission reduction and pollutant emission reduction.

Third, we will vigorously develop green technologies. In order to better protect the environment and public health, oil companies should continue to increase their investment in technology research and development, and promote the development of the oil industry in a green direction to reduce environmental risks.

Fourth, strengthen environmental awareness education. Popularizing environmental protection knowledge among enterprises and individuals, enhancing environmental protection awareness and responsibility level, cultivating civilized habits of environmental protection, and carrying out various environmental protection publicity activities are important contents of petroleum environmental protection work.

4.5. Strengthen international cooperation, expand overseas markets, and improve international competitiveness

Strengthen cooperation and exchanges with other countries in the same industry, improve industrial transparency and internationalization, and build a more open multi-level international cooperation platform.

First, strengthen cooperation with foreign enterprises. Chinese petroleum companies should actively establish strategic cooperative partnerships with domestic and foreign petroleum enterprises, international consulting institutions, and financial institutions, and jointly promote exchanges and cooperation in the field of petroleum technology in various forms and at various levels. This will promote technological innovation and the improvement of energy production efficiency, and promote the internationalization, specialization, and diversification of petroleum enterprises.

Second, deepen cooperation with Belt and Road countries. In recent years, China has taken an active part in the Belt and Road Initiative, strengthened oil industry cooperation with Asian countries, Central and Eastern Europe, and other regions, enhanced oil and gas resource integration and connectivity with relevant countries, enhanced regional security and stability, and promoted the process of economic globalization.

Third, strengthen cooperation with international organizations. China should actively participate in the construction of international organizations and their norms, standards, and agreements, strengthen the cooperation with major energy exporting countries, petroleum trading centers, and other places, promote the global allocation of oil and gas resources and market-based exchanges, and promote the popularization and practice of the concept of sustainable development worldwide.

In a word, choosing the right path of petroleum industry modernization is of great significance for realizing sustainable

development. We must actively promote technological innovation, policy and regulation reform, market competition mechanism construction, and green development, so as to enhance the modernization level of our petroleum industry.

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