International Journal of Energy
ISSN: 2957-9473 | Vol. 6, No. 1, 2025

Study on the Existing Basis and Feasible Path for Coal Enterprises to Accelerate the Formation of New Quality Productivity

Dongwei Shao [1, *], Guoliang Li [2]

[1] Department of Inner Mongolia University of Technology, Hohhot, Inner Mongolia, China
[2] School of Inner Mongolia University of Technology, Hohhot, Inner Mongolia, China

*** Corresponding author:** Dongwei Shao (Email: 2038306452@qq.com)

Abstract: Accelerating the formation of new quality productivity is of great significance to the high-quality development of coal enterprises. This paper analyzes the existing basis for the formation of new quality productivity of coal enterprises from four aspects: policy support, technological innovation, talent base, and transformation of achievements, and proposes that coal enterprises should promote technological innovation on the basis of the existing basis to improve the level of technology, optimize the talent structure, improve the level of management, pay attention to the green innovation, promote the green transformation, and improve the sensitivity of the market to respond quickly to market changes.

Keywords: Coal Enterprises; New Quality Productivity; High Quality Development.

1. Introduction

The 2024 Government Work Report proposes to vigorously promote the construction of a modernized industrial system and accelerate the development of new quality productivity. Give full play to the leading role of innovation, promote industrial innovation with scientific and technological innovation, accelerate the promotion of new industrialization, improve total factor productivity, continuously shape the new momentum and new advantages of development, and promote social productivity to achieve a new leap. [1] New quality productivity is the contemporary advanced productive forces spawned by revolutionary breakthroughs in technology, innovative allocation of production factors, and in-depth transformation and upgrading of industries, which takes the qualitative change of laborers, means of labor, objects of labor, and their optimal combinations as the basic connotation, and the enhancement of total factor productivity as the core symbol[2][3] .

In June 2021, the Coal Industry Association issued the "Guidelines for High-Quality Development of the Coal Industry in the 14th Five-Year Plan", which called for the cultivation of 3-5 world-class coal enterprises with global competitiveness. In order to realize the above goals, set by the state, coal enterprises need to actively realize high-quality development[4] . After 2008, the steel and coal industries began to face the problem of overcapacity. Although China is the world's largest steel producer, there is still a gap between high-end steel and technological innovation, and overcapacity has become a focal point of constraints on the high-quality development of enterprises. For this reason, it is necessary to promote innovation in the coal industry with science and technology to accelerate the formation of new quality productivity.

2. Existing Basis for The Formation of New Quality Productivity in Coal Enterprises

2.1. Increasing Policy Support

Under the current economic situation, coal enterprises, as one of the pillar industries of the national economy, bear great responsibility and mission. However, due to various reasons, the coal industry has been in a difficult situation for a long time, facing problems such as overcapacity, low efficiency and high pollution. In order to change this situation, government departments have introduced a series of policy support measures aimed at promoting the formation of new quality productivity in coal enterprises and enhancing the overall competitiveness of the industry.

First, the government has adjusted and optimized the industrial structure of coal enterprises, promoting their development in the direction of high-end, high-efficiency and low-carbon. Through the implementation of supply-side structural reform, it has eliminated backward production capacity, promoted technological innovation and transformation and upgraded of enterprises, and continuously improved the production efficiency and resource utilization rate of coal enterprises. At the same time, the government has also increased its support for clean coal technology and equipment, which has promoted the transformation of coal enterprises in the direction of clean production and realized the sustainable use of coal resources. Secondly, the government has guided coal enterprises to increase R&D investment and strengthen technological innovation and talent training through financial subsidies and tax incentives. The government encourages enterprises to increase scientific research efforts, break through key technical difficulties, improve product quality and brand influence, and promote enterprises to climb up the value chain. At the same time, the government also promotes the transformation of scientific and technological achievements by supporting universities and scientific research institutions to carry out cooperative

research with enterprises, and promotes the application of technological innovation achievements in production. For example, on March 15, 2023, the National Energy Administration issued the "2023 Energy Industry Standard Plan Project Guidelines", involving the coal industry, there are coal mine intelligence, digitalization, coal mine eco-environmental protection and energy efficiency enhancement, carbon emission reduction and other three major areas of fourteen key directions.

In addition, the Government has strengthened the management of environmental protection and energy conservation and emission reduction in coal enterprises, and has promoted the implementation of green production by enterprises to reduce pollution and damage to the environment. The government has introduced relevant policies and measures to reward enterprises that meet environmental protection standards and severely punish enterprises that violate environmental laws, creating a favorable atmosphere for environmental protection. At the same time, the government also promotes enterprises to increase energy saving and emission reduction efforts, and supports enterprises to adopt energy-saving and environmentally friendly equipment to reduce production costs and improve efficiency. For example, on December 27, 2023, the National Development and Reform Commission (NDRC) issued Decree No. 7 of the National Development and Reform Commission of the People's Republic of China (NDRC) Decree, announcing the "Guidance Catalog for the Adjustment of Industrial Structure (2024 Edition)"[9] . In the Guidance Catalogue, there are 22 items related to coal, of which 4 items are included in the encouragement category, 5 items in the restriction category and 13 items in the elimination category, such as coal trans-regional transportation channels and collection and evacuation systems, intelligent and safe and efficient technology development and application in coal mines, ecological restoration of mines, and clean and efficient development and utilization of technology for coal.

Nearly every year, a large number of related policies are introduced, as shown in Figure 1. In general, the government's policy support for the formation of new quality productivity in coal enterprises has not only brought about external conditions to promote the development of the enterprises, but also enhanced their own competitiveness and sustainable development capability. Coal enterprises have gradually realized the transformation to high-quality development and embarked on the road of sustainable development with the support of government policies. In the future, the government should further improve the policy measures, increase the support for coal enterprises, provide broader space and stronger support for the innovative development of coal enterprises, and promote coal enterprises to move towards a healthier, greener and more sustainable development path. Good policy conditions and social atmosphere will strengthen the institutional foundation for the formation and development of new quality productivity.

Table 1. Selected national policies and references in recent years

timing	Publishing department	Name of policy	Policy content
February 2020	Eight departments, including the Development and Reform Commission, the Energy Bureau and the Ministry of Emergency Response	Guidance on Accelerating the Intelligent Development of Coal Mines	Promote the intelligent development of coal mines and advance the intelligent construction of the whole process of coal production
June 2021	China Coal Industry Association	Guidelines for Quality Development in the 14th Five-Year Plan	Combining the innovation system of industry, academia and research to improve the contribution rate of coal science and technology
January 2022	National Development and Reform Commission, National Energy Administration	Modern Energy System Plan for the 14th Five-Year Plan	Promoting changes in energy consumption patterns
March 2023	National Energy Administration (NEA)	Guidelines for Establishing Energy Sector Standards Programs, 2023	Coal industry has coal mine intelligence, digitalization, coal mine ecological and environmental protection and energy efficiency, carbon emission reduction and other three major areas of 14 key directions
December 2023	PRC National Development and Reform Commission (NDRC)	Guidance Catalog for Industrial Restructuring (2024 Edition)	Coal trans-regional transportation channel and collection and transportation system, coal mine intelligent and safe and efficient technology development and application, mine ecological restoration, clean and efficient development and utilization of coal technology and other 4 items are included in the encouragement category, and there are 5 items in the restriction category and 13 items in the elimination category.

2.2. Gradually Consolidated Technological Innovation Foundation

The key engine to accelerate the formation of new quality productivity is the innovation drive led by scientific and technological innovation, and the integration of scientific and technological innovation elements into the production mode and means of production to promote the innovative development of coal enterprises[10] . The technological innovation of new quality productivity is based on scientific and technological innovation and the integration of innovative elements, which is the key engine to promote the innovative development of coal enterprises. Scientific and technological innovation can introduce new productivity elements into the production process, thus improving production efficiency and production quality. On the other hand, innovation elements can improve and optimize the existing production process, so that productivity can be further enhanced. The core of accelerating the formation of new quality productivity lies in innovation[11] , and coal

enterprises are constantly moving forward in innovation, according to the latest statistics, the number of enterprises with product or process innovation activities has been increasing year by year since 2018, and the proportion of enterprises with product or process innovation activities in so industrial enterprises above the scale has been increasing year by year, as shown in Figure 1. This shows that the coal industry is actively seeking the development path of innovation and has already achieved some results.

On the other hand, coal industry coal industry innovation tournaments are increasing, such as the 2023 National Coal Mining Face Intelligent Innovation Competition organized by China Coal Industry Association, Jining Energy Jinqiao Coal Mine, Zhujiaxuan Coal Mine and Yangcheng Coal Mine won the first, second and third prizes respectively. Paying attention to and participating in coal industry innovation competitions helps enterprises establish and improve their own technological innovation system. Through the competition, enterprises can find their own shortcomings in technological innovation, so as to make targeted improvements. At the same time, enterprises can also take this opportunity to learn and introduce external advanced technology to further improve their own technological innovation ability. In addition, the coal industry innovation tournaments are also conducive to building a technological innovation ecosystem within the industry[12] . Through the competition, it can continuously promote the updating and modernization of technology, form benign competition, and then promote the technological progress and development of the whole industry. Good innovation conditions and innovation incentives contribute to the formation of new quality productivity

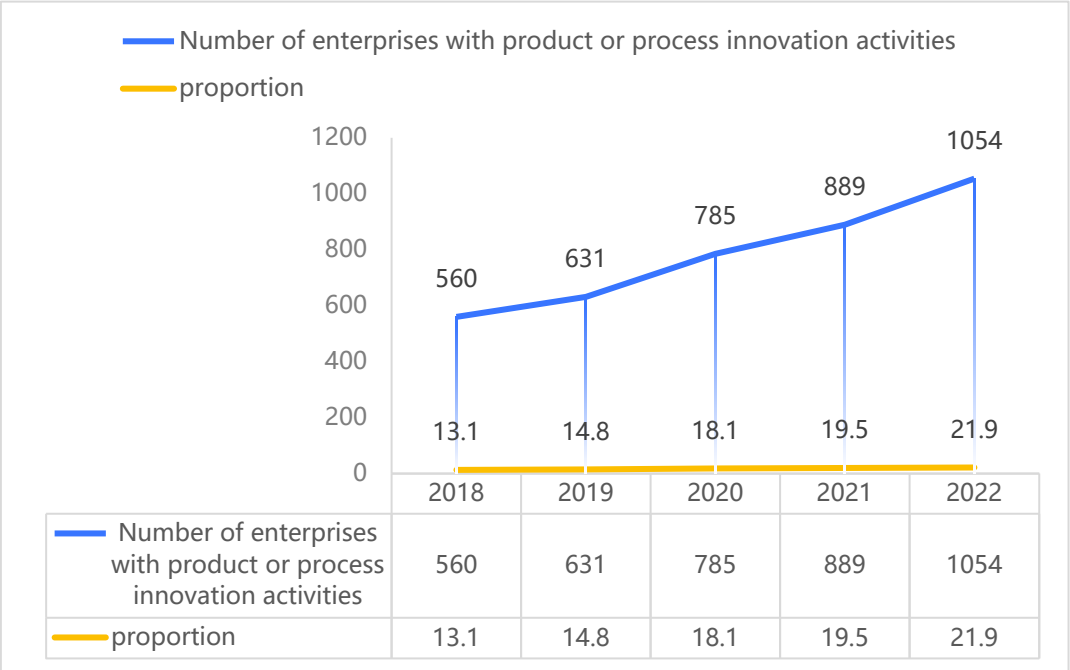


Figure 1. The number of enterprises with product or process innovation activities has been increasing year by year since 2018, and the proportion of enterprises with product or process innovation activities in so industrial enterprises above the scale has been increasing year by year

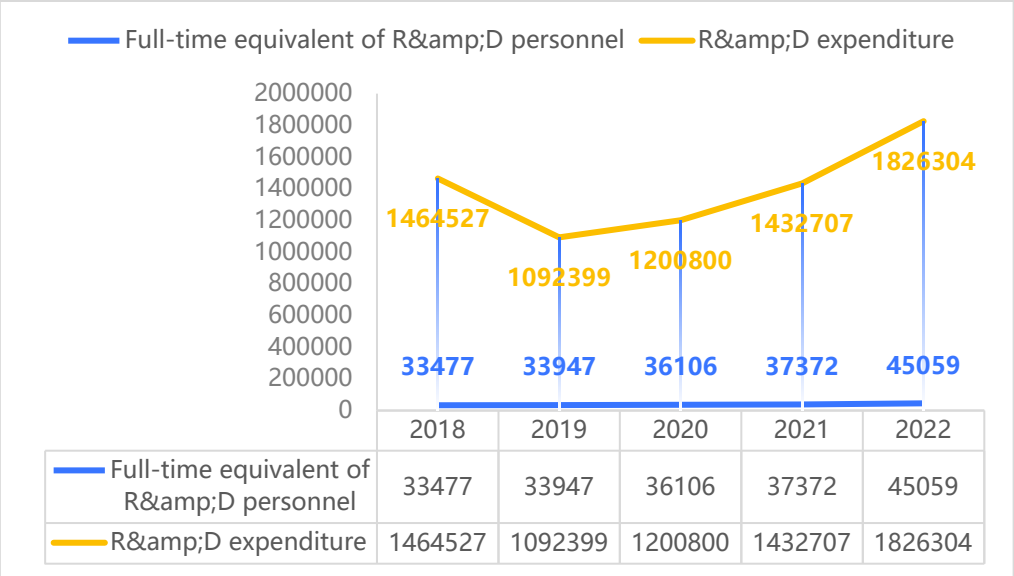
2.3. Growing Talent Base and Capital Investment

The development and progress of society is centered on the creativity of human beings, both in terms of satisfying the needs of the subject and developing the essence of the subject. Whether it is traditional productivity or new quality productivity, human beings are the core[13] . The new quality of productivity requires the full play of human ingenuity. As an important factor in the improvement of key core technology capacity, coal enterprises emphasize the combination of industry, academia and research, actively cultivate high-level scientific and technological innovation talents, and continuously improve the R&D funding to create a good atmosphere for innovation. Measures such as the realization of quantitative assessment of the whole process of scientific research projects, the implementation of comprehensive budget management for scientific research funds, and the realization of intellectual property protection for the full coverage of scientific researchers have strengthened the motivation of employees to innovate.

The latest data show that the R&D personnel inputs and funding inputs of coal enterprises have been increasing since 2018, as shown in Figure 2. These inputs are mainly used to research and develop new mining equipment, improve the efficiency of ore refining technology, and improve environmental protection measures. With the continuous progress of science and technology, the coal industry has shifted from the traditional mining method to a more technological production mode. The construction of a new quality productivity base does not stop at R&D investment and facility upgrades. In fact, the establishment of a new quality productivity base requires an all-encompassing, in-depth reform. This reform requires not only technological innovation, but also comprehensive adjustments in organizational structure, management style and corporate culture. Only in this way can enterprises effectively improve their core competitiveness in the new production environment, so as to realize sustainable development. Coal enterprises have also made efforts to this end, such as Shenhua Group, which utilizes advanced management tools to guarantee a steady improvement in the company's operational efficiency.

Shendong adheres to positive incentives as the main focus, and has established an assessment system that links daily assessment and monthly rating to salary allocation, which guarantees that the company's development concepts and development goals are well implemented. By extending lean management to all aspects of coal production, operation management, maintenance and manufacturing, it promotes in-depth analysis of processes in all aspects of daily operations by all mines and units, optimizes the operation flow, and strives to increase the effective production time and improve the operation efficiency.

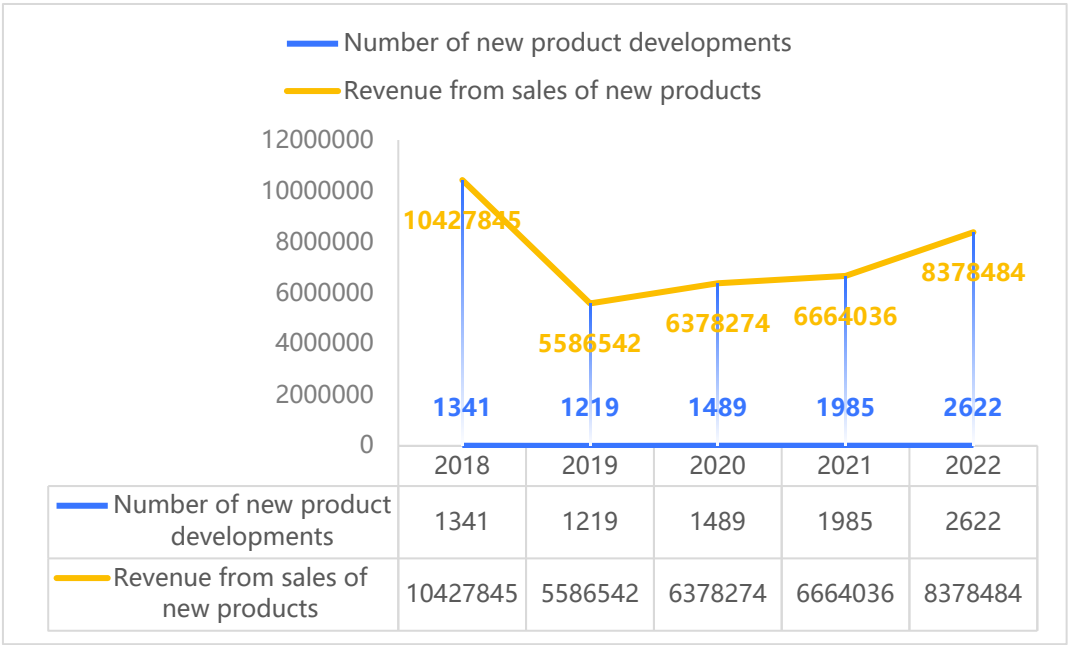
Coal enterprises attach importance to the training of innovative talents, forming three channels for the development and growth of production and management talents, professional and technical talents, and highly skilled talents, and constantly increasing the investment in innovation funds, creating conditions for the formation of new quality productivity.



	2018	2019	2020	2021	2022
Full-time equivalent of R&D personnel	33477	33947	36106	37372	45059
R&D expenditure	1464527	1092399	1200800	1432707	1826304

Figure 2. R&D staffing and financing

2.4. Progressive and Efficient Results-Based Transformation



	2018	2019	2020	2021	2022
Number of new product developments	1341	1219	1489	1985	2622
Revenue from sales of new products	10427845	5586542	6378274	6664036	8378484

Figure 3. Number of new product developments and sales revenue

Accelerating the transformation of scientific and technological achievements is the key link to realize the key core technology support capability and the optimization and upgrading of industrial chain, and it is an important link to promote the formation of new quality productivity of coal enterprises[13] . How to transform scientific and technological achievements into actual productivity to meet the changing market demand and continuously improve its competitive ability in the national policy and market competition has become an important issue for the current and future development of coal enterprises. The basis for accelerating the transformation of scientific and technological achievements is to improve the scientific research capability. Coal enterprises are market-oriented, pay attention to

scientific and technological innovation, and invest more funds and human resources in scientific research activities. Secondly, coal enterprises have established a perfect mechanism for the transformation of scientific and technological achievements, including the evaluation, appraisal, promotion and application of scientific and technological achievements.

The basis of the transformation of the results of the new quality productivity can not only look at the initiatives of coal enterprises, but also need to pay attention to the specific transformation data. In recent years, the number of effective invention patents, the number of new product projects, and the sales revenue of new products in China's coal enterprises have been steadily increasing, as shown in Figure 3.

3. Paths to Realizing the Accelerated Formation of New Quality Productivity

3.1. Promote Technological Innovation and Upgrade the Level of Technology

Strengthen R&D investment and build an innovation system. Coal enterprises should increase R&D investment, set up specialized R&D institutions, gather high-quality R&D talents, and form core technologies with independent intellectual property rights. Through industry-university-research cooperation, technology innovation alliance and other ways to build an open innovation system, attract external innovation resources, and promote the transformation and application of technological achievements. Promote advanced technology and upgrade equipment level Coal enterprises should actively introduce advanced coal mining, washing, processing and other technologies at home and abroad, promote intelligent and automated technology and equipment, and improve production efficiency and product quality. At the same time, strengthen the maintenance and renewal of equipment to ensure stable operation and safe production. Strengthen the management of technological innovation, improve the innovation mechanism coal enterprises should establish and improve the management mechanism of technological innovation, clear innovation goals, tasks and responsibilities, to ensure that technological innovation work is carried out in an orderly manner. At the same time, improve the innovation incentive mechanism, reward and honor individuals and teams who have achieved outstanding innovation results, and stimulate the enthusiasm of employees for innovation.

Deepen the cooperation between industry, academia and research and promote the transformation of achievements Coal enterprises should strengthen the cooperation with universities and scientific research institutions to jointly carry out research on coal technology innovation and promote the transformation and application of scientific research achievements. Through technology transfer, cooperative development and other means, the deep integration of production, learning and research can be realized, and the technical level and market competitiveness of coal enterprises can be improved.

Implement the innovation-driven development strategy to build the core competitiveness of enterprises. Coal enterprises should take technological innovation as the core strategy of enterprise development, throughout the whole process of production, operation and management of the enterprise. Through continuous technological innovation, build the core competitiveness of enterprises and realize the sustainable development of enterprises. At the same time, actively participate in international competition and cooperation, learn from international advanced experience and technology, and enhance the international competitiveness of enterprises.

Strengthen the risk prevention and control of technological innovation to guarantee the safety of innovation. In the process of promoting technological innovation, coal enterprises should attach great importance to technological innovation risk prevention and control. Establish a perfect risk assessment, early warning and response mechanism to discover and resolve innovation risks in a timely manner. Strengthen the protection of intellectual property rights, prevent technology leakage and infringement, and guarantee the innovation security of enterprises.

3.2. Optimize Talent Structure and Improve Management Level

Define the talent demand and optimize the recruitment strategy. Coal enterprises should define the type, quantity and quality requirements of talents needed according to their own development strategy and market demand. In the recruitment process, it is necessary to pay attention to the professional skills, practical experience and comprehensive quality of the candidates, and select talents with development potential. At the same time, it is necessary to improve the recruitment process to ensure the fairness, impartiality and effectiveness of recruitment. In addition, coal enterprises should also establish close cooperative relationships with universities and research institutions to jointly cultivate high-quality talents that meet the needs of enterprises. Strengthen talent training and improve the quality of employees. For existing employees, coal enterprises should develop a perfect training program to improve the business ability and comprehensive quality of employees. The training content should include professional skills, safety production, environmental protection regulations and other aspects. Through regular training and learning, employees can adapt to the needs of enterprise development and improve work efficiency. At the same time, coal enterprises should also encourage employees to learn independently and provide employees with necessary learning resources and support.

Improve the incentive mechanism to stimulate the potential of employees. An effective incentive mechanism can stimulate the enthusiasm and creativity of employees and promote the development of the enterprise. Coal enterprises should establish a reasonable salary system to ensure that the income of employees is closely related to their contributions. In addition, the promotion mechanism should be improved to provide employees with more development space and opportunities. Through the selection of outstanding employees and the establishment of reward funds, etc., employees' enthusiasm for work and sense of belonging are stimulated. Implement refined management to improve management efficiency. Refined management is an important trend in modern enterprise management and the key to improve management level. Coal enterprises should establish a sound management system and process, and clarify the responsibilities and authority of each department and position. Improve management efficiency by implementing digitalization and informationization management. At the same time, it is necessary to pay attention to the needs and feedback of employees, strengthen communication and

collaboration, and form a good corporate culture atmosphere.

3.3. Emphasize Green Innovation and Promote Green Transformation

Strengthening green technology research and development and application. Coal enterprises should increase investment in green technology research and development, and develop and promote energy-saving and emission reduction, resource efficient utilization and environment-friendly technologies for the whole process of coal mining, washing, processing and utilization. For example, by improving coal mining methods and optimizing mine design, they can reduce the waste of resources and environmental pollution in the process of coal mining; adopt advanced coal washing technology to improve the quality of coal products and reduce the content of harmful impurities such as ash and sulfur; and research and develop high-efficiency and clean-utilization technologies for coal, such as coal gasification and coal liquefaction, to improve the conversion efficiency of coal and reduce the emission of pollutants.

Constructing circular economy industry chain. Coal enterprises should actively build a circular economy industry chain to realize the recycling of coal resources[15] . Through the comprehensive utilization of coal gangue, coal sludge and other wastes, the development of new building materials, chemical raw materials and other products to improve the added value of resources; at the same time, to promote the resourceful utilization of waste, such as the use of gangue to generate electricity, the production of compound fertilizers, etc., to reduce the emission of solid waste, and to achieve the reduction, resourcefulness and harmlessness of waste.

Promote ecological restoration and environmental governance in mining areas. Coal enterprises should attach great importance to ecological restoration and environmental governance in mining areas, and take ecological restoration measures, such as afforestation and land reclamation, to restore the ecological environment in mining areas; at the same time, they should strengthen the treatment of water pollution and the prevention and control of atmospheric pollution in mining areas, and set up a perfect environmental monitoring and management system to ensure the effective implementation of various environmental protection measures.

Strengthening enterprise green management Coal enterprises should establish a perfect green management system and integrate the green concept into the whole process of enterprise management. Through the development of green development strategy, the implementation of green procurement, the implementation of green production, green marketing and other measures to strengthen the green management of enterprises. At the same time, strengthen the green training of enterprise employees, improve their environmental awareness, and form a good atmosphere of full participation in green transformation. Deepen the cooperation and communication among industries, universities and research institutes. Coal enterprises should strengthen cooperation and exchange with universities and scientific research institutions to jointly carry out green technology innovation and research and development. Through the cooperation between industry, academia and research institutes, sharing innovation resources, accelerating the development and popularization of green technology, and providing strong technical support for the green transformation of coal enterprises.

References

[1] LI Xinping, HUANG Ford, LIN Liwei. Accelerating the formation of new quality productivity[N]. People's Daily, 2024-03-05(006).

[2] Hu Ying, Fang Taikun. Revisiting the Connotation Characteristics and Formation Path of New Quality Productivity--Taking Marx's Productivity Theory as a Perspective [J/OL]. Journal of Zhejiang Gongshang University, 1-13 [2024-03-15].

[3] Yao Shujie, Zhang Xiaoqian. Era connotation, strategic value and realization path of new quality productivity[J/OL]. Journal of Chongqing University (Social Science Edition),1-17[2024-03-15].

[4] Liu Panpan. Guiding Opinions on High-Quality Development of Coal Industry in the 14th Five-Year Plan[N]. China Mining News, 20200804, (001).

[5] Jue Wang. New Quality Productivity: A Theoretical Framework and Indicator System[J]. Journal of Northwestern University (Philosophy and Social Science Edition),2024, 54 (01): 35-44.

[6] Zhang Lin, Pu Qingping. Connotative Characteristics, Theoretical Innovation and Value Implications of New Quality Productivity[J]. Journal of Chongqing University (Social Science Edition),2023, (6):137-148.

[7] WAN Changsong, XU Zhiyuan, CHAI Yajie. New Quality Productivity Theory[J/OL]. Journal of Henan Normal University (Philosophy and Social Science Edition),1-6[2024-03-15].

[8] ZHOU Wen, XU Lingyun. On the New Quality Productivity: Connotation Characteristics and Important Focus Points[J]. Reform,2023(10):1-13.

[9] Xia Xiaowo. National Development and Reform Commission Revises and Releases Guidance Catalog for Industrial Structure Adjustment (2024 Edition) [N]. Mechatronics Business Daily, 20240115, (A01).

[10] Accelerate the formation of new quality productivity to enhance the new momentum of development [N]. Guizhou CPPCC News, 2023-10-19(002).

[11] YIN Ximing, CHEN Jin, WANG Huafeng et al. Strengthening the leadership of science and technology innovation and accelerating the development of new quality productivity [J/OL]. Science and science and technology management:1-10[2024-03-15].

[12] Jonathan Gruber. A Brief History of American Innovation [M]. CITIC Publishing Group, 2021:14, 373 pp.

[13] Zhang Sen, Wen Jun. Digital economy empowers new quality productivity: an analytical framework[J/OL]. Contemporary Economic Management,1-12[2024-03-15].

[14] Lai, H.N. How to drive new industrialization through the construction of a new science and technology national system--an analysis from the perspective of the five-year plan[J]. Journal of Nanjing University of Science and Technology (Social Science Edition),2022,35(05):1-9.

[15] ZHANG Hui, TANG Qi. Conditions, direction and focus of new quality productivity formation[J]. Learning and Exploration, 2024,(01):82-91.