

# Exploration of the Governance Model of State-owned Joint Venture and Cooperative Shale Gas Companies

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## Abstract

Promoting the modernization of the governance system and governance capacity of state-owned enterprises is the overall goal of China's state-owned enterprise governance reform, and it is necessary to continuously improve and innovate the corporate governance model. Based on the consideration of multiple factors such as capital, technology, resources, market share and risk, state-owned shale gas enterprises carry out shale gas exploration and development in the form of joint ventures and cooperation, so as to achieve resource sharing, risk sharing and mutual benefit and win-win results, and ensure social stability and energy security. This paper focuses on the joint venture and cooperative development governance model of China's state-owned shale gas enterprises. Firstly, this paper analyzes the necessity of state-owned shale gas joint venture and cooperative governance, summarizes the typical experience and problems of state-owned shale gas joint venture and cooperative governance, constructs the governance model of state-owned joint venture and cooperative shale gas companies, and then puts forward suggestions for governance optimization, so as to provide reference and reference for the optimization of the governance model of state-owned joint venture and cooperative shale gas companies and the governance reform of China's state-owned enterprises, so as to promote the high-quality development of China's shale gas industry.

## Keywords

State-owned Enterprise Governance; Joint Ventures; Shale Gas; Governance Model.

## 1. Introduction

As an important material and political foundation of socialism with Chinese characteristics, state-owned enterprises not only have the functional attributes of private enterprises, but also make significant contributions to promoting China's economic construction and social development. Since China entered a new era of promoting high-quality development with new quality productivity, practicing new development concepts, and building a new development pattern, the CPC Central Committee with General Secretary Xi Jinping at the core coordinates the two overall situations, the scientific world view and methodology are applied to the governance of state-owned enterprises, and a series of important expositions are made on the governance of state-owned enterprises and their problems[1]. The current goal of China's state-owned enterprise governance reform is to "Improve the modern corporate governance system of state-owned enterprises with Chinese characteristics, and promote the modernization of the corporate governance system and governance capacity of state-owned enterprises". General Secretary Xi has stressed for many times that "the bowl of energy must be in his own hands". Ensuring national energy security and strengthening domestic oil and gas exploration and development is a long-term and sustainable major strategy of the CPC and China[2]. State-

owned oil and gas enterprises can create economic and social benefits through the efficient development and rational utilization of oil and gas resources, which can not only maintain social harmony and stability, but also guarantee the security of national energy supply.

Central joint venture mode is the state and local government joint investment management, risk sharing and sharing the benefits of a mode of economic cooperation, state use their own capital advantage in local production, set up sales independent legal entity, tax pay warehousing place, expand local fiscal revenue, use of local government for land, market and customers and other local resources to open the local market. The mode of central and local cooperation is that central enterprises make use of local resources and policy advantages to integrate resources and expand their business. Local governments drive local economic growth through cooperation with central enterprises and realize cooperation and coordination at the government level. State-owned shale gas enterprises choose joint venture and cooperation to carry out the exploration and development of shale gas resources, which is based on multiple factors such as capital, technology, resources, market share and risk, so as to realize resource sharing, risk sharing and mutual benefit and win-win results.

However, "shale gas revolution" with Chinese characteristics is still on the road, facing the complex external environment, state-owned shale gas enterprises to deal with good, solve the various aspects of the challenges and difficulties, explore a based on national development strategy and demand, with Chinese characteristics, accord with their own actual situation, effectively realize the development of high quality of state-owned joint venture shale gas corporate governance mode. In this paper by analyzing the motivation of state-owned joint venture shale gas governance, target, common mode, subject and tools, discusses the state-owned joint venture shale gas company governance typical experience, from the target system, management system and governance mechanism optimization of three aspects to build state-owned joint venture shale gas company governance mode, finally put forward the corresponding governance optimization Suggestions, to a certain extent, it has enriched the theoretical research on state-owned enterprise governance, and provided the theoretical and practical basis for the improvement of the governance capacity and governance mode optimization of state-owned shale gas companies and the reform of China's state-owned enterprises.

## **2. The Necessity of Exploring the Governance Mode of State-owned Joint Venture**

### **2.1. Analysis of Joint Venture of State-owned Shale Gas Enterprises**

Because shale gas efficient development has important realistic value, will be conducive to China's energy structure optimization and low carbon energy system, at present China's shale gas industry is in a rapid growth stage, state-owned shale gas enterprises on shale gas rapid scale strategy, choose the way of joint venture cooperation of shale gas resources exploration and development. Joint venture and cooperation of state-owned shale gas enterprises has become one of the directions that must be adhered to and developed in the institutional reform of oil and gas energy field and the governance reform of state-owned enterprises[3]. The joint venture and cooperative governance analysis of state-owned energy companies can be carried out from the aspects of governance motivation, governance objectives, common modes, subject relationship and governance tools.

State-owned shale gas enterprises choose to joint venture cooperation of the main motivation includes five kinds. The first is the financial needs, the global energy economic recovery, the energy industry market concentration and investment demand soared, state-owned shale gas enterprises with other capital advantage or local government joint cooperation, Shared investment risk and reduce their financial pressure, realize the utilization of funds. The second

is the demand for technology. Through joint ventures, state-owned shale gas enterprises can realize complementary advantages in technological research and development innovation and production and operation, and improve their own exploration and development technology level, production capacity and efficiency. The third is the demand of resources: our country is in the energy structure of low carbon transformation and shale gas industry the critical period of rapid growth, in the face of increasingly fierce market competition and market environment, state-owned shale gas enterprises choose joint venture cooperation can integrate resources sharing resources resource allocation optimization, improve the utilization rate of resources. Fourth, the need for market competitiveness: state-owned shale gas companies through joint ventures with other companies or local governments in various value activities, Improve and develop existing products or services, Into new regional markets and even global markets, Increase their own sales volume, market share and international competitiveness; Fifth, risk-related demand: the energy industry has high market risks and policy risks, Joint ventures and cooperation of state-owned shale gas enterprises can share risks and responsibilities, Provide a more solid capital base and security, In addition, joint ventures and cooperation with some regional enterprises and governments with an entry threshold for foreign investment, It can help state-owned shale gas companies avoid policy restrictions and smoothly enter relevant local markets.

**Table 1.** Comparative analysis of the joint venture and cooperation mode of state-owned shale gas enterprises

Common Mode	Characteristic	Advantage	Shortcoming
Peer Joint Venture	Each party to the joint venture cooperation shall have the same proportion of equity or capital investment, with equal rights and share responsibilities and risks.	The rights and interests of all parties are equal, the absolute control of one party is avoided, and the trust and cooperation of all parties are strong.	The conflict of interest between the parties of the joint venture, leading to difficult decision-making.
Holding Joint Venture	In the joint venture, one party holds more shares than the remaining parties, has the dominant position and absolute controlling equity, and the remaining parties are the controlling parties.	The holding company can play its professional advantages, have greater decision-making power and control, and better implement their own management mode.	The interests and interests of the controlling party are limited, which may reduce the trust of cooperation.
Cooperative Development	The parties in the joint venture will achieve win-win cooperation in resource development and supply chain integration to jointly develop resources.	All parties should share the results of resource development and reduce risks.	All parties need to trust each other and want to cooperate, otherwise cooperation conflicts may arise.
Technical cooperation	All parties to the joint venture shall share technology, knowledge and experience, jointly develop new technologies and share technological achievements.	All parties should make use of their technological advantages and resources to improve their market competitiveness.	All parties need to have technological advantages and complementarity, otherwise the cooperation will be unsustainable.
Comprehensive Cooperation	The parties to the joint venture cooperation shall conduct comprehensive cooperation in capital, technology, market and other fields to jointly promote development.	All parties should integrate their own resources to form joint forces and develop together in various levels and fields.	All parties need to trust each other, otherwise there may be multiple cooperation conflicts.

The objectives of joint venture and cooperation of state-owned shale gas enterprises mainly include improving production efficiency and technical level, reducing their own costs and risks, improving product quality and service quality, expanding the market and customer base, enhancing market competitiveness and social responsibility, and realizing central and local linkage and open innovation. State-owned shale gas enterprises can expand their business and increase their production capacity through joint ventures and promote the common development of all parties. There are five common joint venture and cooperation modes of state-owned shale gas enterprises, and their respective characteristics, advantages and disadvantages are shown in Table 1.

**Table 2.** Different governance objectives, governance practices and governance tools corresponding to different governance subjects

Governance Subjects	Governance Goals	Governance Practices	Governance Tools
Government	Ensure national energy security and achieve coordination between the central and local governments	Specify energy sector policies and plans	To issue policy documents and specify development plans
		To supervise the operations of state-owned enterprises	Auditing, evaluation, and supervision
		Provide financial support and subsidies	Subsidy policies, loans and financial support
		Coordination and future development	Planning, coordination and resource integration
State-owned Shale Gas Companies	Improve economic benefits, market competitiveness and social responsibility, and promote technological innovation in exploration and development	Formulate the economic benefit management strategy	Setting and management of business plan and financial indicators
		Enhance market competitiveness and efficiency	Assets restructuring, the adjustment of the industrial structure
		Promote innovation in exploration and development technologies	Technology research and development and the introduction, innovation and competition
		Improve corporate social responsibility	Environmental protection and public welfare undertakings, employee welfare treatment, social information disclosure system
External Joint-venture Partners	Share the benefits and risks	All parties should share the results of resource development and reduce risks.	All parties need to trust each other and want to cooperate, otherwise cooperation conflicts may arise.

The governance system of state-owned shale gas enterprises is complex and the governance subjects are various, mainly including the government, State-owned shale gas companies and the external tripartite joint venture partners. Government through the guidance and supervision of policies and regulations of the company's management behavior, the internal organization through the formulation and implementation of corporate governance structure, specification and articles of association, promote the development of the company

management and the strategy, external tripartite joint venture partners through the introduction of capital, technology and market resources, promote the company's business expansion and diversified development. The cooperation and cooperation between these governance subjects is conducive to improving the production and operation efficiency of state-owned shale gas enterprises, reducing risks, enhancing market competitiveness and realizing sustainable development.

The joint venture and cooperation management tools of state-owned shale gas enterprises mainly include: joint venture and cooperation strategic agreement, articles of association, company management system, etc. Among them, the joint venture and cooperation strategic agreement is a key tool to protect the legitimate rights and interests of all parties and coordinate the joint venture and cooperation relationship; the articles of association defines the internal management system, power and responsibility distribution, decision-making procedures, and is the legal basis and binding document for the agreed relationship in the joint venture and cooperation of state-owned shale gas enterprises; Company management system including the organization management system and supervision and management system, establish and improve the company organization management system is very important for state-owned shale gas enterprises, not only helps to improve the company's operational efficiency and management level, effectively prevent business risk, also can promote the development of company cooperation with partners, achieve sustainable development.

To sum up, the governance objectives, governance practices and governance tools corresponding to different governance subjects of the joint venture and cooperation of state-owned shale gas enterprises are summarized, as shown in Table 2.

## **2.2. Summary of the Joint Venture and Cooperation Management Experience of State-owned Shale Gas Enterprises**

State-owned shale gas companies using state and local government joint venture development of shale gas resources with the reform of state-owned enterprise reform, oil and gas and strategic cooperation macro policy requirements, through learning successful joint venture cooperation experience, learn from failure experience, improve their governance ability and market competitiveness. The experience of state-owned shale gas joint venture and cooperative company governance model can be summarized into five points:

The first is to highlight the government's push for shale gas development, The joint venture cooperation of state-owned shale gas companies is closely related to the strong boost of local governments, Integrate resource management, investment and development, technology research and development, market services and financial funds, Promote the development of shale gas industry clusters, Create a good environment for the development of shale gas industry. Second, attach importance to the party organization to lead the corporate governance, Leadership and role of Party organizations in the governance of state-owned shale gas companies, Promote enterprise development to keep consistent with the party's principles and policies, Ensure the clean and efficient operation of enterprises, To realize the unity of economic benefits and social benefits. Third, we should adhere to the concept of shared development, The joint venture and cooperation of state-owned shale gas companies adhere to the new development concept and implement the regional coordinated development strategy, It has implemented the market economy model that promotes the development of mixed ownership of state-owned enterprises and realizes win-win cooperation among all parties. Fourth, adhering to the concept of harmonious development, Adhere to the concept of inclusive and shared development, To establish a stable and orderly social environment and a market environment. Fifth, to focus on our core competitiveness and our capacity for independent innovation, State-owned shale gas companies play a key role in major national strategies such as building an innovative country, building "Belt and Road" and building a manufacturing

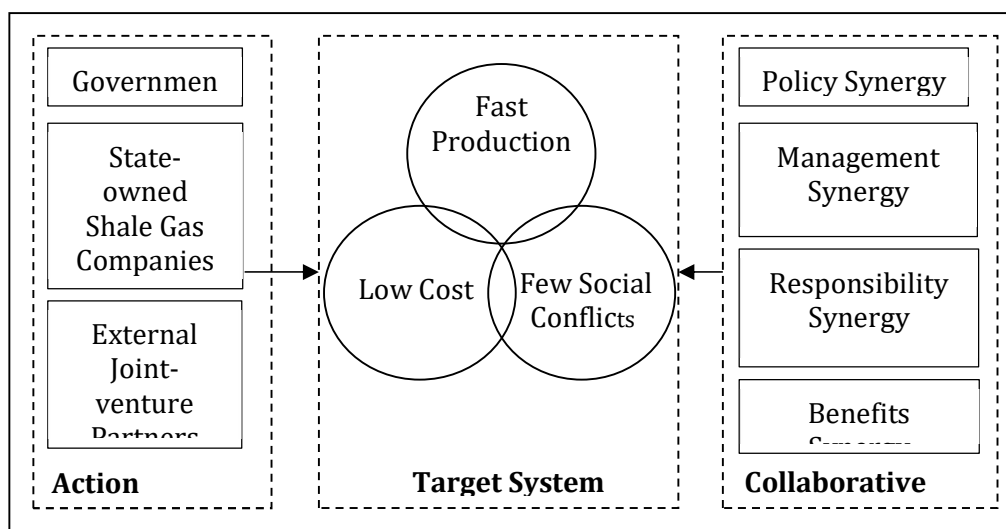
power, focusing on cultivate and strengthen core competitiveness and independent innovation capabilities.

### 3. State-owned Joint Venture Cooperation Shale Gas Corporate Governance Model Construction

#### 3.1. State-owned Joint Venture and Cooperative Shale Gas Company Governance Target System Was Established

In the governance of state-owned joint ventures and cooperative shale gas companies, it is crucial to establish a clear target system. The target system shall include the overall development goals and specific project goals of the company, among which the overall development goal is the long-term development strategy of the company, and the specific project goals are the goals set for each shale gas development project. By establishing a clear governance target system, it can provide a clear direction and guidance for the development of the joint venture and cooperative shale gas companies, and lay a solid foundation for the efficient development of shale gas.

With carbon peak, carbon neutrality, China's ecological civilization construction and the construction of modern energy system to provide macro background and target guidance for state-owned joint venture shale gas company governance, there are "ideal types" of state-owned joint venture shale gas company governance. Based on the stakeholder theory, the "ideal type" of the state-owned joint venture shale gas corporate governance model can be abstracted into a conceptual model, including the behavior subject, target system and collaborative system. First of all, focus on the governance practice of state-owned joint venture shale gas companies, the stakeholders mainly include the government, state-owned joint venture shale gas companies, external joint venture partners, etc. Secondly, the governance of state-owned joint ventures should be included in the transformation process of national energy security and economic and social low-carbon, green and sustainable development, and the governance goals should be faster production, low cost and less social contradictions. Thirdly, the governance of state-owned joint ventures and cooperative shale gas companies needs to coordinate and deal with the interest relationship between various subjects and mobilize their enthusiasm. The "ideal type" of the state-owned joint venture and cooperative shale gas corporate governance target system is detailed in Figure 1:



**Figure 1.** The governance target system of state-owned joint venture and cooperative shale gas company is "ideal type"

### 3.2. The Governance System of State-owned Joint Venture and Cooperative Shale Gas Company is Sound

Governance system refers to the organizational structure and management system among the government, enterprises, social organizations and other participants needed to achieve the governance goals. The governance system of state-owned joint venture and cooperative shale gas companies is established on the basis of laws and regulations and the articles of association, including the organizational structure and decision-making procedures of the company. In terms of organizational structure, the rights and responsibilities of the management and the joint venture partners should be clarified to ensure the balance of rights and responsibilities and clear responsibilities; in the decision-making procedures, a scientific and reasonable decision-making mechanism should be established to ensure the transparency of the procedures. To establish and improve the state-owned joint venture shale gas corporate governance system, it is necessary to coordinate the interests of the company and other governance subjects in shale gas exploration and development, promote win-win cooperation, ensure the efficiency and sustainability of corporate governance, standardize the operation of the company, and improve the management level of joint venture and cooperation, which can start from three aspects:

The first is to clarify the role and responsibilities of government regulation, and the government plays a role in policy formulation, regulation and supervision in the governance of state-owned joint ventures. On the one hand, the government formulates relevant policies and laws to clarify the ownership and management system of shale gas resources and provide legal guarantee for the governance of state-owned joint venture shale gas, the government guarantees the legitimacy and sustainability of state-owned shale gas governance through environmental assessment, resource exploration and production supervision. The second is to strengthen the win-win cooperation among the joint venture partners. The state-owned joint venture and cooperative shale gas company promotes the efficiency and benefit to achieve the win-win situation: on the one hand, give full play to their respective advantages, reduce development costs and improve development efficiency; on the other hand, jointly develop new technologies and new markets through technical cooperation and market cooperation, and achieve win-win cooperation. The third is to establish a sound risk management mechanism to ensure the smooth progress of state-owned joint venture shale gas corporate governance: On the one hand, the joint venture parties jointly deal with the market risks to reduce the technical risks of shale gas exploration and development; on the other hand, the government can timely detect various risks through risk assessment and risk monitoring, and ensure the safety and sustainability of shale gas exploration and development and state-owned joint venture shale gas corporate governance.

### 3.3. Optimization of the Governance Mechanism of State-owned Joint Venture and Cooperative Shale Gas Companies

Governance mechanism, The full name is the "governance structure and regulatory system", The governance structure and the regulatory system jointly form a corporate governance mechanism, Governance mechanism refers to the rules, procedures and restraint mechanisms observed by the governance participants in the governance process, When the state-owned joint venture and cooperative shale gas companies build a governance mechanism, Consider multiple factors, Including policies and regulations, corporate governance structure, partners, joint venture and cooperation strategic contracts, risk management mechanism, performance evaluation and supervision mechanism, And strictly implement the relevant regulations and systems in all links of governance, To ensure the smooth progress of state-owned joint venture and cooperative shale gas corporate governance and the maximum interests of all governance subjects.

First, policies and regulations, State-owned shale gas companies should first abide by the relevant national policies and regulations when constructing the joint venture and cooperative governance mechanism, Including the management measures of shale gas exploitation, the policies and regulations of participating in the joint venture and cooperative exploitation of shale gas, Strictly comply with the relevant laws and regulations, Ensure the legality and standardization of joint venture cooperation. Second, the corporate governance structure, State-owned joint venture and cooperation of shale gas companies to establish a sound corporate governance structure, Ensure the transparency and effectiveness of the decision-making mechanism, Emphasis on the management and decision-making of joint venture and cooperation, Ensure that their respective interests are safeguarded. Third, the joint-venture partners, State-owned joint venture cooperation shale gas companies should carefully choose partners, Its experience and resources in the shale gas sector, And its reputation and credibility in the market, The joint venture partner shall fit with the development strategic objectives of the Company, conducive to the joint development of shale gas. Fourth, the strategic contract for joint venture and cooperation, The strategic contract of joint venture cooperation shall specify the rights and obligations of all parties, Including investment amount, resource allocation, operation and management, risk sharing, profit distribution and other aspects, Ensure the fair and reasonable design. Fifth, the risk management mechanism, State-owned joint venture and cooperation shale gas companies should carefully analyze and evaluate the risks in technology, market, policy, operation and other aspects, Establish a sound risk management mechanism, Effectively respond to various risks that may occur in joint ventures, Ensure the sound operation of joint venture and cooperative governance. Sixth, the performance evaluation and supervision mechanism, State-owned joint venture and cooperation of shale gas companies to establish an effective performance evaluation and supervision mechanism, Regularly supervise and evaluate the business performance, risk status and performance of partners of various business activities, Find out the problems in time and take measures to solve them.

#### **4. Suggestions on Optimizing the Governance of State-owned Joint Venture and Cooperative Shale Gas Companies**

In recent years through continuous reference and practice to explore, China's state-owned enterprises mixed ownership reform has made great progress, advancing the reform of state-owned enterprise corporate governance system and management ability, China's shale gas exploration and development enterprise technology level and talent level, organization ability and management ability has made great progress, state-owned joint venture shale gas corporate governance to good, solve the challenge of various aspects, explore a based on the national development strategy and demand, realize the sustainable development of high quality path, from the following aspects:

##### **4.1. Improve the Transparency and Openness of Corporate Governance**

In the process of optimizing the governance of state-owned joint ventures and cooperation in shale gas companies, it is crucial to enhance transparency and openness. This will not only help to enhance the public's trust in the company, but also can effectively promote the information exchange and communication among various stakeholders, and reduce the potential risks caused by information asymmetry. Therefore, the company should take the initiative to fulfill the obligation of information disclosure, and regularly, accurately and completely release key information such as business status, financial status and strategic planning. At the same time, the company also needs to establish an effective communication mechanism, actively respond to social concerns, and enhance the company's social responsibility and credibility.

#### 4.2. Strengthen the Personnel Training and Introduction Mechanism

Talent is the core driving force of enterprise development. In order to enhance the competitiveness of state-owned joint venture shale gas companies, the company should pay attention to talent training and introduction. Specifically, a perfect talent training system should be established, and high-quality talents with international vision, innovative spirit and professional quality should be cultivated through the combination of internal training and external introduction. At the same time, the company should also actively seek cooperation opportunities with well-known enterprises and universities, introduce advanced management experience and technological achievements, and provide strong support for the sustainable development of the company.

#### 4.3. Promote the Innovation of Governance Model and Technical Means

In the context of the rapid development of digitalization and intelligence, state-owned joint venture and cooperative shale gas companies should actively explore innovative governance models and technical means. By the introduction of blockchain, artificial intelligence and other advanced technologies, improve the intelligent level of corporate governance, improve the efficiency and accuracy of governance. At the same time, the company should also strengthen the exchange and cooperation with international advanced enterprises, learn from its advanced governance experience and technical means, and provide strong support for the improvement and innovation of the corporate governance system.

#### 4.4. Strengthen the Construction of Corporate Culture

As the soul and spiritual pillar of an enterprise, corporate culture is of great significance for improving the quality of corporate governance. Therefore, the state-owned joint venture and cooperative shale gas companies should pay attention to the construction of corporate culture, and establish the corporate values of integrity, innovation, cooperation and win-win as the core. By organizing various cultural activities and carrying out social welfare, we will promote corporate culture and enhance the social image and brand value of enterprises. At the same time, the company should also pay attention to the inheritance and development of corporate culture, to lay a solid foundation for the long-term development of the company.

### 5. Conclusion

Ensuring national energy security in the new era and new situation is a long-term strategy. State-owned oil and gas enterprises can create benefits and maintain social stability and national energy security by efficiently developing oil and gas resources. The governance mode of joint venture between central and local governments is to establish governance mechanism and promote economic development by exploring the common interests of both sides and using their respective advantages and resources.

State-owned shale gas enterprises choose joint ventures and cooperation to meet the challenges. Factors include: capital demand, technology demand, resource demand, market competitiveness demand and risk demand. The governance goal is to improve production efficiency, reduce costs and risks, improve product quality and services, expand the market, enhance competitiveness and social responsibility, and realize the linkage and open innovation between the central and local governments. Common joint venture cooperation mode: reciprocal joint venture, holding joint venture, cooperative development, technical cooperation and comprehensive cooperation. The governance subject includes the state (government), the internal organizations of the enterprise and the external tripartite joint venture partners. Governance tools include: joint venture and cooperation strategic agreement, articles of association, company management system, etc. State-owned shale gas joint venture and cooperation can be divided into absolute holding and relative holding. The two modes have

their own advantages and disadvantages, which are conducive to improving the efficiency of enterprises. The experience of state-owned shale gas joint venture and cooperation governance mode includes five points: government promotion, Party organization guidance, shared development, harmonious development and focus on core competitiveness. However, there are also problems in the shale gas joint venture cooperation mode, including that it is difficult to balance the short-term and long-term interests, the government and the superior enterprises require short-term profits, which affect the long-term development, the heterogeneous stakeholders, difficult to unify the governance objectives, and differences in resource allocation, market development and environmental protection, which affect the efficiency and stability of joint venture cooperation. Third, the transaction cost of investment decision is high, negotiation, negotiation and other costs consume a lot of resources, reduce the efficiency of joint venture and cooperation and return on investment.

The construction of state-owned joint venture shale gas corporate governance model includes the governance target system and governance system and governance mechanism optimization. The governance goal contains political, economic, social and environmental friendliness. It is necessary to coordinate the interests of all subjects, mobilize the enthusiasm of the government, enterprises and communities, and form a common awareness and concept of action. The governance system involves the organizational structure and management system among the government, enterprises and social organizations. The rights and responsibilities of the management and all parties should be clarified, and a scientific decision-making mechanism should be established to ensure the transparency of the procedures and improve the management level. Governance mechanism including governance structure and regulatory system, need to consider policies and regulations, governance structure, partners, strategic contracts, risk management mechanism and performance evaluation supervision factors, ensure smooth governance and the main body benefit maximization, carefully choose partners, clear strategic contract, improve the risk management, establish effective performance evaluation and supervision mechanism.

To sum up, the optimization of shale gas corporate governance in state-owned joint ventures can be started from the following aspects: comprehensive Party organizations participate in corporate governance, integrate resource advantages, form collaborative governance mode, innovate operation mode and management methods, strengthen the construction of corporate culture, and strengthen cooperative partnership.

## References

- [1] X.G. Liu, The solution and enlightenment of Chinese modernization to the theoretical problem of state-owned enterprise governance [J]. *Journal of Beijing Union University (Humanities and Social Sciences edition)*, 2023, Vol. 21 (3): 1-9.
- [2] X. He, C.Y. She, Z.M. Cheng, et al. Promote the management mode innovation of high-quality development of shale gas development [J]. *Scientific and Technological Achievements of China*, 2022, Vol. 23 (13): 65-69.
- [3] W.L. Xu, G.Y. Yang. Practice and thinking of innovation mode of cooperation between central enterprises and oil and gas development and local governments in the 13th Five-Year Plan [J]. *International Petroleum Economy*, 2019, Vol. 27 (12): 22-30.