

Construction of Digital Investment Management System for Oil and Gas Exploration Projects

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Abstract

Oil and gas exploration refers to the geological survey, geophysical exploration, drilling and related activities in order to identify exploration areas and prove oil and gas reserves, which is the first key link of oil and gas exploitation. In the context of energy revolution and energy transformation, it has become a trend to accelerate the digital transformation of the oil and gas industry and realize the intelligent development of the oil and gas industry, which is the only way for petroleum and petrochemical enterprises to achieve high-quality development. China has been actively promoting the digital transformation of oil fields, and has proposed a three-step strategic deployment of "digitalization, intelligence and intelligence" for oil fields. Based on the research on the digital management system of exploration projects, combined with the investment management objectives, this paper accelerates the mining and transmission of exploration information through the big data information platform, improves business efficiency, and explores the establishment of an innovative investment management system for exploration projects with "big data dynamic integration".

Keywords

Oil and Gas Exploration; Project; Digital; Investment Management.

1. Introduction

In recent years, scholars at home and abroad have carried out a lot of research on exploration project investment management from different perspectives, such as geological characteristics of resource areas, returns and risks, investment portfolio optimization and so on, and formed a series of achievements for reference. Foreign scholars' research mainly focuses on the innovation of project investment management methods, while domestic scholars' research on exploration project investment mainly focuses on a certain aspect of project management or the application of a certain management method, and discusses the application of real options in exploration project investment management. However, there are still some shortcomings in the existing research, for example, the research on exploration project investment management has not formed a complete system, and the application of various methodologies is not guided by scientific principles. For another example, with the development of big data technology, the deep integration of digitalization and various investment project management has become an inevitable trend, but there is a gap in the theoretical research of exploration project investment management under the background of digitalization by domestic and foreign scholars.

In view of this, this paper will closely follow the process of digital exploration, explore and innovate the exploration project investment management process under the background of big data, and build a set of digital exploration project investment management system that meets

the requirements of current investment management. The innovation management system and the actual exploration project production management are deeply integrated, and a set of exploration project digital investment management mode which can fully adapt to the current exploration project management needs is established.

2. Construction Ideas of Digital Investment Management System for Oil and Gas Exploration Projects

The construction of digital investment management system for exploration projects of oil field enterprises mainly starts from four aspects, namely, the construction of enabling framework, the innovation of risk management system, the optimization of organizational structure and the design of management operation mechanism.

First, build a digital enabling framework. The construction of digital enabling framework for oil and gas exploration investment projects mainly empowers exploration project investment management from three aspects: operational intelligence, management intelligence and decision intelligence. Digitization runs through the whole process of project management, realizing digitalized and intelligent exploration project management and forming a dynamic chain investment management system. Constantly update the value creation ability and value-added level of the enterprise, to achieve the improvement of its own core competitiveness.

Secondly, innovate the oil and gas exploration investment project digital risk management system. The digital risk management system of oil and gas exploration investment projects is mainly divided into four aspects: first, establish a complete set of big database to better realize the management and control mode in different stages and Spaces; Second, build a dynamic risk early warning mechanism to facilitate the rationalization of project investment decisions; Third, share the investment risk reasonably and integrate the different responses of relevant parties to achieve a "win-win" or "multi-win" situation; Fourth, establish hierarchical management of risk early warning of investment projects to ensure the safety of investment projects.

Thirdly, optimize the organization structure of digital investment management of oil and gas exploration projects. The optimization of the organizational structure of the digital investment management of oil and gas exploration projects is mainly to add the big data process control section and the Investment risk Control section on the basis of the original organizational structure, so that the company can control the entire exploration investment process and the risks in the process more conveniently and efficiently. Each department has the obligation to promote the development of investment projects, do a good job of business docking with other departments, carry out special research work, prepare industry analysis reports as early as possible, carry out solid professional basic work, and do a good job in the construction of project information base and expert information base.

Finally, design the operation mechanism of digital investment management of oil and gas exploration projects, which refers to the combination of various functions that need to be realized during the normal operation of the project and the relationship between various components of the system. Based on the general requirements and specific elements of the operation mechanism, the paper puts forward the sharing mechanism of data interaction, the monitoring mechanism of real-time tracking, the review mechanism of the integration of industry and finance, the strategy-oriented incentive mechanism and the digital composite talent training mechanism.

3. Build a Digital Enabling Framework for Oil and Gas Exploration Investment Projects

The construction of "big data-dynamic-integration" digital enabling framework for oil and gas exploration investment projects mainly analyzes and optimizes the company's business processes from three different levels, namely, the execution level, the operation management level and the strategic decision-making level. As shown in Figure 1, it organically integrates various business value activities of the enterprise to form a dynamic chain investment management system. Constantly update the value creation ability and value-added level of the enterprise to achieve the improvement of its own core competitiveness.

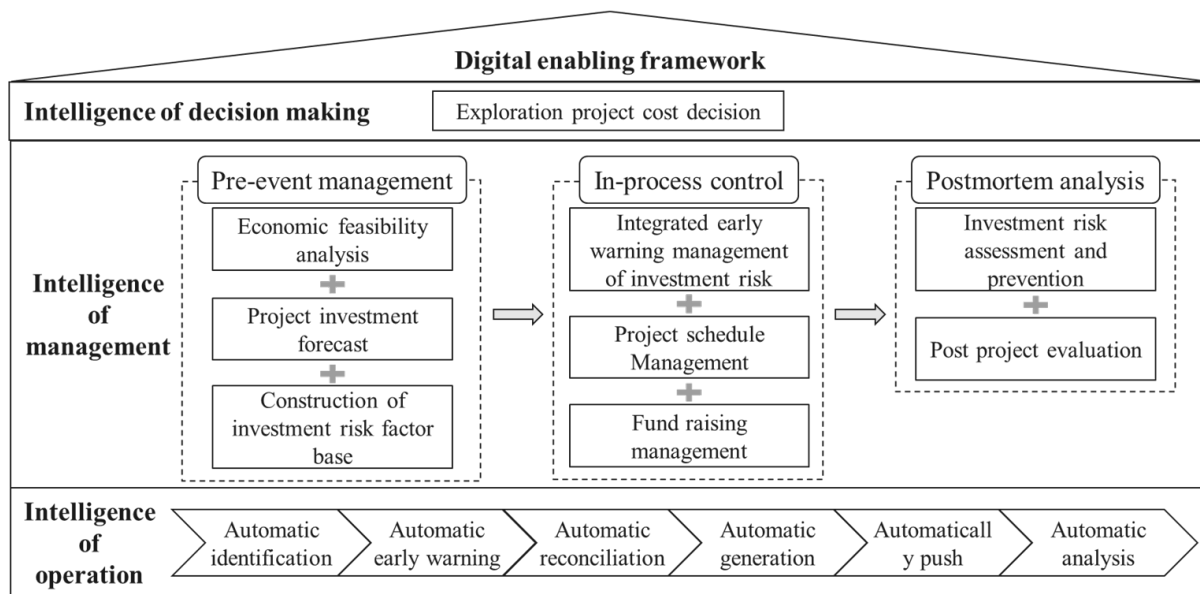


Figure 1. Digital enabling framework for oil and gas exploration investment projects

3.1. Digital Execution Job Layer

In the research of exploration project digital investment management mode, the main task of the executive layer is to use the Internet, big data, automation, intelligent and other technologies to process the massive information in the whole process of exploration project investment management, upload it to the cloud system, and automatically process it through intelligent equipment. To solve the problems of investment management, such as the huge volume of data, the number of personnel back and forth, and the serious waste of human and material resources. The automation and intelligent technologies mainly applied in this paper include automatic identification, automatic warning, automatic reconciliation, automatic generation, automatic push, automatic analysis and so on.

3.2. Digital Operations Management

Operation management is a middle-level organization in the management hierarchy. Its main function is to formulate, formulate and decompose objectives, and draw up specific implementation plans, processes and steps. According to the requirements of strategic objectives, allocate human and material resources according to the department, coordinate the production and operation activities of the lower organization, evaluate the results of the production activities of the lower department, and formulate the corresponding corrective measures. In the exploration project digital investment management mode, the main tasks of the operation management include project investment forecast, economic feasibility analysis, investment risk factor base construction, project schedule management, investment risk

integrated early warning management, fund raising management, project post-evaluation and investment risk assessment and prevention.

3.3. Digital Strategy Decision-Making Level

Under the exploration project digital investment management mode, the decision-making level is the upper organization of the management level. Its main function is to carry out unified command and coordination management for the whole enterprise department organization from the overall interests of the enterprise, and formulate a series of rules and regulations and policies. The strategic decision-making level mainly involves the cost decision of exploration projects, analyzing the cost composition of exploration projects, comparing with the same industry, finding out the gap, studying the reasons for the high cost of exploration Wells, evaluating the existing measures to improve quality and efficiency, and proposing optimization measures, such as finding the average value and interval of the same Wells for technical factors and geological factors. The content mainly includes the database of controlling factors of functional project cost, the database of measures to improve quality and efficiency, and the mining of cost drivers by using cost big data.

4. Innovate Digital Risk Management System for Oil and Gas Exploration Investment Projects

4.1. Construct Big Data Risk Factor Database

After the collection and identification of big data, a complete set of big databases of investment risk factors should be summarized to better realize the management and control mode in different stages and time and space.

Establish a large database requires three sub-systems: "pre", "processing" and "display". The pre system is the data collection and classification system, which takes all the risk factor information after risk identification as data preparation and screens according to different risk categories to grasp all the factor data information. It not only pays attention to the information effectiveness, but also can be comprehensively collected. Processing system, select the corresponding commercial software or self-built program for data processing; Results display system, the data processing results into a chart or a variety of easy to view the form.

In the exploration project investment risk factor database, all risk factors should be classified and collected using the big data pre-processing subsystem, and then the input data in the database should be processed according to the data processing subsystem. Finally, the display system can be used to obtain the statistical table of data results, the dynamic graph of data results and the output value of the data results information base.

4.2. Construct Dynamic Risk Early Warning Model

Build a dynamic risk early warning mechanism to help the rationalization of project investment decisions. By establishing a special organization, using certain regulatory tools as media, and using scientific methods to analyze the data reflecting the whole process of enterprise operation and management activities. An information system that encourages decision makers to take appropriate measures to nip risks in the bud. In practice, most enterprises limit the target of risk management to control financial risk. That is to use the financial data, select appropriate indicators to establish a certain precision model, and then use the model to distinguish and prevent investment risks. According to the research status at home and abroad, the early-warning models can be divided into univariate early-warning model and multivariate early-warning model. The multi-variable early warning model is adopted to eliminate the judgment bias caused by single variable factors.

4.3. Integrate Risk Stakeholders Reflect

Exploration projects involve many stakeholders, including the government, project contractors, suppliers, operators, private investors, banks, insurance and product users, etc., and the relationship between rights and obligations is complicated. In practice, relevant stakeholders always try to transfer risks to achieve maximum benefits with minimum risks, which requires the continuous integration of different responses of risk stakeholders, especially the government and project stakeholders. Exploration projects should achieve a "win-win" or "multi-win" situation. Therefore, it is necessary to share the investment risk reasonably and integrate the different responses of related parties, which is the key problem of investment risk management.

4.4. Design Risk Assessment Grade

In order to strengthen the real-time monitoring of the invested projects, prevent the risks of investment projects, standardize the investment behaviors and ensure the safety of investment projects, the risk early-warning hierarchical management of investment projects is established, and the abnormal situations or risks that have occurred or may occur are suggested, summarized and analyzed. It is divided into multiple levels according to the categories, and prevention and control is carried out from top to bottom of each level.

5. Optimize the Organizational Structure of Digital Investment Management for Oil and Gas Exploration Projects

The design of the digital investment management organizational structure of oil and gas exploration projects aims to strengthen the management and control of the investment process of exploration projects and the risk factors in the process, strengthen the project implementation effect and prevent project risks by adjusting the original organizational structure and adding new departments. This paper mainly adds the Big Data Process Control Department and the Investment Risk Supervision Department on the basis of the original organizational structure.

The Big Data Process Management and Control Department is responsible for monitoring and evaluating the implementation of each business in the process, and tracking the implementation effect. The Big Data Process Control Section has a process sorting room and a process monitoring room. Process sorting room is responsible for sorting out the exploration investment process suitable for the characteristics of each exploration project according to the general flow chart; The process monitoring room supervises and manages the work of the whole process according to the progress of the project, so as to ensure the smooth completion and acceptance of the project.

The Investment Risk Supervision Section consists of three branches: Big Data Technology Analysis Room, Risk Integrated Management Room and Dynamic Target Research Room. As the direct superior organization, the Investment Risk Supervision Section is responsible for supervising the work process of the three studios, reviewing important projects and work processes, and strictly controlling investment projects. The Statistical analysis Room of Big data technology, the dynamic target laboratory and the Risk integration Management Room are the three branches of the dynamic integration model of big data respectively. Among them, the statistical analysis room of big data technology needs to process, transmit, publish and share data; The Dynamic target lab focuses on each sub-target of the whole life cycle of the investment project; The Risk integration Management Office is responsible for integrated management of the investment risk management process, investment risk organization system, risk data analysis and actual operation in the whole life cycle.

6. Design the Operation Mechanism of Digital Investment Management for Oil and Gas Exploration Projects

Exploration project is a complex system engineering. Coupled with big data, dynamic and integrated digital investment management system for exploration project, the operation process needs to be more systematic and organized. The operation mechanism of the digital investment management system includes three important contents, which are respectively: the thinking of the management system, the business process and the organizational structure. The idea is the overall idea of the whole management system, and other operating mechanism functions should always maintain the consistency with the overall idea; A business process is a series of activities that transform a particular business from input to output. The organizational structure refers to the organic whole established by the members of the organization for the completion of specific tasks. The elements interact with each other and depend on each other. The effective control of all aspects of the project is the specific function of the system.

In different stages of digital investment management of oil and gas exploration projects, each mechanism has its own clear positioning and plays different roles. Among them, the constraint mechanism is the dominant mechanism in the initial stage, and the constraint on the control nodes in the process of the project is the basis to promote the rapid development of various value activities of the enterprise. With the deepening of the project, the exchange of information becomes more frequent and the degree of collaboration between various departments is also continuously improved. At this time, the sharing of human resources, financial resources, data resources and material resources becomes the focus of project management and operation. On the premise of ensuring the sharing and utilization of various resources, it is the key for enterprises to give full play to their resource complementary advantages and generate their core competitiveness to enable all departments to carry out collaborative innovation activities in an orderly manner under the unified goal. The evaluation mechanism of the integration of industry and finance and the digital composite talent training mechanism will run through the whole operation stage. The former will adjust the project to the safe state under the promotion of the internal needs of the enterprise and the external environment; The latter gives full play to the advantages of talents to build a high-quality compound talent team. Therefore, the monitoring mechanism of real-time tracking, the sharing mechanism of data interaction and the innovation mechanism are the key points in the growth stage of project management operation. When the production and operation activities can bring stable value creation to the enterprise, the project management operation enters the mature stage. At this time, in order to realize the sustainable development of value creation and improve the business efficiency of the enterprise, the strategy-oriented incentive mechanism is required to play a major role, and the experience summary and appropriate incentive are carried out regularly to ensure the enterprise operation has a steady flow of power.

7. Peroration

It is a complex and arduous project to make digital transition of oil and gas industry in our country. "Digitalization" is not only a technology, but also a way of thinking and a new business model and consumption model. It provides a new way for petroleum and petrochemical enterprises to organize, produce, make decisions and innovate, and drives profound changes in the production mode. The digital investment management system for oil and gas exploration projects constructed in this paper is relatively comprehensive and in line with the attributes of oil and gas exploration projects. It can provide important guarantee for the continuous breakthrough and discovery of all exploration project investment management of the business department, which also can accelerate the pace of digital transformation of exploration project

investment management and help the oil field industry realize visualization practice and application of digital oil reservoir, digital wellbore, intelligent drilling and completion.

References

- [1] LIUZhuo, ZHANG Yu, ZHANG Hongyang. Development trend and strategy of digital oilfield technology at home and abroad [J]. Petroleum Science and Technology Forum, 2020 (04): 62-67.
- [2] XU Le. Exploration Big data construction status and existing problems [J]. China Management Informatization, 2021 (05) :95-96.
- [3] REN Zekun, CHEN Xiao, XU Le. Current situation and prospect of digital transformation of oil and gas field exploration [J]. Oil & Gas & New Energy, 2022 (01) :67-73.
- [4] YANG Jianfeng, DU Jinhua, YANG Yong, et al. Research and practice of digital transformation in oil and gas industry [J]. Acta Petrolei Sinica, 2021 (02) :248-258.
- [5] LOU Haijun, WANG Yibin. Research on project risk Management based on risk database [J]. Contemporary Economics, 2010 (21) :120-123.
- [6] JIANG Teng. Model Analysis of Business risk warning [J]. Finance and Trade Research, 2007 (3): 154-155.
- [7] WANG Lin, XUE Liangqing, SHI Buqing, et al. Structure and practice of the "Trinity" management Model of petrochina overseas oil and gas exploration [J]. China Petroleum Exploration, 2016 (02) :16-19.
- [8] WANG Feifei. Risk Analysis and Control Research of offshore Oil and Gas exploration Projects [D]. Daqing, Northeast Petroleum University, 2012.