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Oil and Gas Improvement in Offshore Engineering under the Guidance of New Technology

Suzana Ahmad*

Jimma Institute of Technology, Ethiopia

**corresponding author*

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Abstract: In recent years, my country's dependence on foreign oil and gas has been rising. With the sharp fluctuations in international oil prices, the uncertainty of overseas oil and gas improvement benefits of domestic oil companies has been increasing, and the importance of improvement evaluation has become increasingly prominent. Based on value and risk evaluation, it is more suitable for offshore engineering oil and gas improvement to help domestic oil companies improve efficiency, avoid risks, ensure my country's energy security, and promote the healthy improvement of oil and gas improvement. In the experiment, the objective function method and decision-making technology are used to analyze the application cases under the guidance of the new technology. The experimental results show that from 2018 to 2021, the organization and implementation of the improvement plan will be strictly followed, and 98.1% and 95.3% of the planning indicators will be completed respectively, the production index conformity rate is relatively high, basically consistent with the planning index.

1. Introduction

Oil and gas improvement areas are important national energy production bases. Due to the long-term exploitation of oil and gas resources, the natural ecological environment systems such as local water bodies, grasslands, land and forests have been greatly affected, resulting in an imbalance between ecological supply and demand in some regions. Ecosystems are under a lot of pressure [1]. In order to understand the current level of ecological pressure in the oil and gas resource improvement area and its main sources, and to provide suggestions for the subsequent ecological construction of the oilfield, it is necessary to study the ecological carrying capacity of the oil and gas resource improvement area.

The successful improvement of oil and natural gas energy is an important guarantee for

promoting my country's economic improvement. As an important stage in the improvement of the entire oil and gas field, the preliminary project of oil and gas field improvement seriously affects the improvement of the entire oil industry chain. Mansour A M studied the advantages of FPSOs in that they can provide storage and offloading capabilities that other types of FPSs do not have. In addition, FPSO provides a large deck area and ample topside payload capacity. They are used in various water depths and environments around the world. It is a good solution for offshore oil and gas improvement for oilfields that lack an offshore export pipeline system. However, due to their inherent high motion in waves, the types of risers they can carry are limited. Low Motion FPSO is a novel design designed to maintain the advantages of conventional FPSOs while providing significantly reduced motion response. The design of low-motion FPSO generally consists of a box-shaped hull with large storage capacity, a free-hanging solid ballast tank located at a certain distance below the hull keel, and several groups connecting the free-hanging solid ballast tank with the hull. It consists of tendons, mooring system and riser system for maintaining the station [2]. Pavlyuk M I describes the history of geological exploration and oil and gas exploration in the Eastern European platform waters. The structure of hydrocarbon deposits is described. The main improvement stages of tectonic structures in the platform sea area and the geodynamic conditions for the formation of oil and gas areas are expounded, which lays the foundation for in-depth exploration, target search and reconnaissance. Up-to-date and reinterpretation of previously obtained geological material is analyzed and its hydrocarbon potential is assessed [3]. The Twining G study, led by the University of Edinburgh and an international team of researchers, will map an uncharted region of the Atlantic Ocean from Iceland to South America to analyse the health of its ecosystems. Hope to gain insight into how climate change affects plant and animal life in the oceans. The researchers also intend to analyze the impact of commercial activities on the ecosystem, such as deep-sea mining, fishing, and oil and gas improvement [4]. As cooperation involves management, technology, personnel and other factors, offshore oil and gas improvement is prone to expose some problems, which affect the smooth implementation of cooperation projects. It is necessary to improve management and improve efficiency.

Through the classification of oil and gas improvement projects, this paper studies the technical feasibility, necessity, urgency of decision-making and comprehensive evaluation, and proposes decision-making technology in oil and gas improvement. In the experiment, based on the basic situation of M oilfield from 2018 to 2021, using the objective function method, in the application case analysis guided by the new technology, the main production index data of M oilfield and the main operating index data of oil and gas improvement projects were analyzed. Investigation and Analysis.

2. Research on Offshore Oil and Gas Improvement Guided by New Technology

2.1. Classification of Oil and Gas Improvement Projects

There are various classification standards and methods for the classification of oil and gas improvement projects. The main classification methods include the scale of oil and gas resources, characteristics of oil and gas resources, improvement methods, management levels, types of owners, and improvement areas [5-6]. According to the nature of the project, it is divided into exploration, improvement, engineering technology, ground engineering, system support, equipment, safety and environmental protection, quality management and energy saving, scientific and technological information, etc., respectively. decision [7-8]. According to the size of the project combined with the organizational structure of the petroleum enterprise, it is divided into four levels, and the management departments at different levels such as the headquarters, professional branches, regional companies, etc., according to the provisions of the documents, make project decisions as

shown in Table 1:

Table 1. Lifecycle management of oil and gas improvement projects classification

Classify	management levels	Reserve scale	Stable production scale
Class I	Group Company	Over 30 million tons	More than 500,000 tons
Class II	Professional branch	Between 10-30 million tons	300-500,000 tons
Class III	Regional branch	Under 10 million tons	Less than 300,000 tons
Class IV	Oil production plant or operation area	Old area adjustment encryption and rolling expansion of the edge of the production capacity construction blocks	

2.2. Technical Feasibility, Necessity and Urgency Decision-Making and Comprehensive Evaluation

The technical feasibility decision-making held an expert meeting to demonstrate whether the relevant elements of the technology have the application conditions. Including data acquisition, reservoir geological characteristics (stratum, structure, deposition, reservoir), reservoir properties (crude oil properties, temperature and pressure characteristics, oil-water distribution, reserve estimation), early improvement test experience, reservoir engineering (improvement mode, well type selection, oil production parameter optimization), whole life cycle index prediction Surface engineering (wellhead selection, gathering and transmission, steam injection, crude oil treatment, sewage treatment system, clean water treatment, softened water treatment, saline sewage treatment, water supply, power supply and distribution, fuel supply, communication, instrument automation, fire fighting, roads) and a series of technical problems [9-10]. The decision-making of construction necessity focuses on the application of qualitative analysis methods to analyze the possible impact of changes in the internal and external environment of the oil field and whether the oil field is adjusted or not. It is problem-oriented and combs the current problems. The implementation of the urgency decision focuses on the decision-making of the project construction rhythm, and analyzes the time nature of the project, whether there is a comparison, and the choice of the project construction opportunity from the perspective of the whole life cycle. The comprehensive evaluation method of two factor evaluation is adopted for the adjustment scheme of oil and gas projects, and the evaluation results are fully discussed at the expert meeting. In fact, in addition to the technical and economic factors, other factors such as environment and society are also considered, but the mathematical model of multi factor evaluation is not used [11-12].

2.3. Research on Decision Technology in Oil and Gas Improvement

Decision making should take into account the relationship between short-term and long-term, local and overall [13-14]. The decision-making of oil field exploration and development has changed from scale improvement to benefit improvement, which can take improving the final oil recovery of the oil field as the long-term goal or improving the annual improvement benefit as the short-term goal; The improvement decision-making of oil and gas field enterprises can be oriented to improve the core competitiveness of the enterprise, strengthen and expand the exploration and improvement business, optimize and simplify the supporting business, or improve the comprehensive strength of the enterprise, and integrate upstream, downstream, industry, University and research; The organization can be set up in a flat way to improve efficiency, or in a fine management and three-dimensional way; The decision-making of the organization setting of oilfield projects can be made by highlighting the benefits of individual projects, organizing and setting according to the full life cycle management, or highlighting the overall benefits, organizing and setting according to the traditional matrix (Intelligent Management) [15-16]. Therefore, there is no

right or wrong in the decision-making itself. As long as the decision-making time node, the decision-making method and technology are appropriate, and the decision-making results can adapt to various environmental conditions and even constraints at that time, the decision-making itself is successful. This paper puts forward personal opinions on the application methods of decision-making technology for different types of oil and gas field improvement projects, and hopes to carry out discussion on decision-making technology and constantly improve the decision-making technology for oil and gas field improvement projects.

The decision-making theory has been very mature, and the decision-making technology is diverse. In different types of oil and gas improvement projects, they should be combined according to the situation, and the best scheme should be selected for the problems to be solved [17-18]. However, the decision-making process cannot be overstepped. Before making a decision, a comprehensive evaluation form should be prepared to ensure that the decision-making process is in place. The main contents of oil and gas improvement project decision-making include scale decision-making, necessity decision-making, urgency decision-making, technical feasibility decision-making and economic feasibility decision-making, with project scale and economic decision-making as the core.

3. Investigation and Research on Offshore Engineering Oil and Gas Improvement under the Guidance of New Technology

3.1. Basic Information of M Oilfield

M oilfield was discovered in the 1950s, with a total of 412 million tons of resources and 241 million tons of proven resources. From 2018 to 2021, we will carry out superheated steam injection huff and puff and SAGD breakthrough tests. According to the improvement idea of "testing, tackling key problems and building production", we will complete the improvement plan in December 2021. From 2018 to 2021, the project was organized and implemented in strict accordance with the improvement planning scheme. The accumulated production capacity was 3.3214 million tons, and the production of crude oil was 4.567 million tons, 98.1% and 95.3% of the planning indicators respectively. The compliance rate of production indicators was high, which was basically consistent with the planning indicators.

3.2. Objective Function

Maximize the economic benefits of the life cycle of oil and gas improvement projects. Where, cycle (T) is the whole life cycle of the project; profit Π Is the profit of the project; The price (PT) is the crude oil price in year t; The output (QT) is the output of the t-th year; The cost (CT) is the cost of year t; Investment (it) refers to the investment in year t; Capacity (XT) - the capacity in year t; The discount rate is R; Net present value (NPVT) is the net cash flow of the project in year t. The objective function is:

$$NPV_t = \frac{P_t Q_t - I_t - C_t}{(1+r)^{t+1}} \tag{1}$$

$$Max\Pi = \sum_{t=1}^{T} NPV_t = \sum_{t=1}^{T} \frac{P_t Q_t - I_t - C_t}{(1+r)^{t+1}} \tag{2}$$

4. Analysis and Research on Offshore Engineering Oil and Gas Improvement under the Guidance of New Technology

4.1. Application Case Analysis under the Guidance of New Technology

In 2018-2021, the price of natural gas increased. Considering the benefit factor, the fuel structure of an oil field was adjusted, and the large-scale construction of a circulating fluidized bed coal-fired steam injection boiler was started. Affected by the requirements of environmental assessment procedures and difficulties in applying for environmental protection indicators, the construction progress lags behind and the pace of construction and production slows down. The main production indicators of M oilfield are shown in Table 2 and figure 1:

Table 2. Comparison of main production index of 2018-2021

Project	Planning of 4 years	Reality of 4 years
Completed drilling number (ports)	3152	3965
Drilling footage (ten thousand meters)	203.5	184.1
New production capacity (ten million tons)	452.3	407.8
Oil production (ten million tons)	851.4	891.2

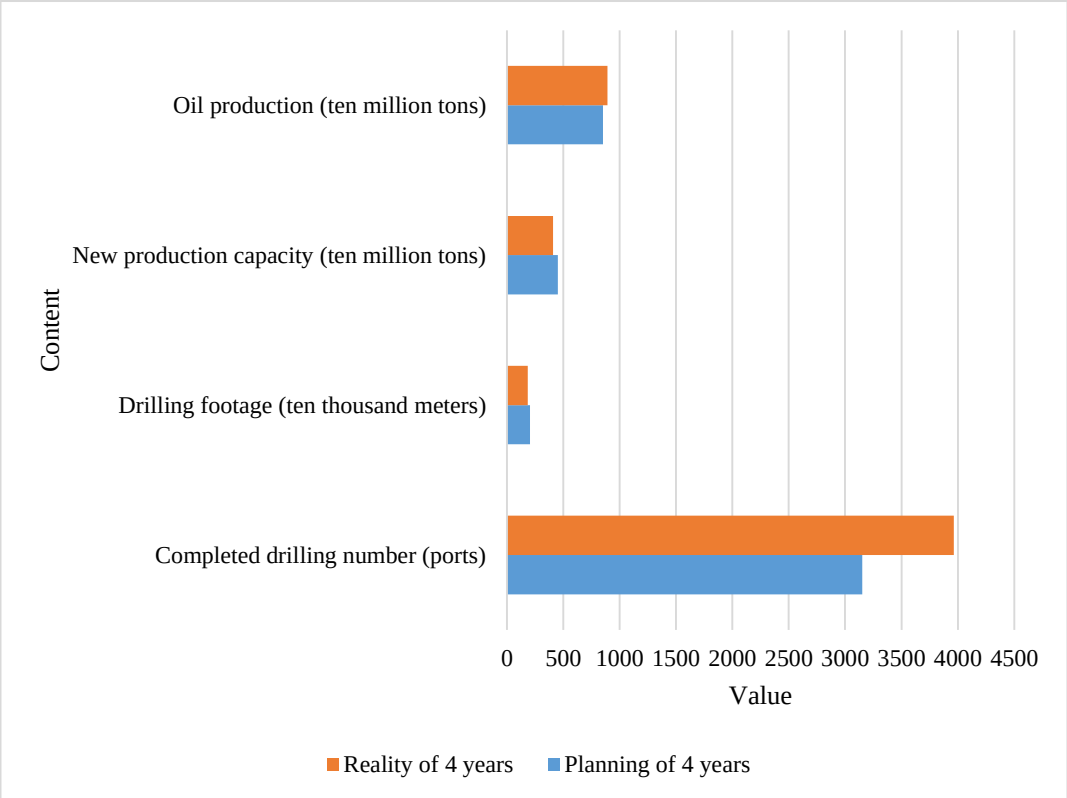

Figure 1. Comparison chart of four-year production index data

4.2. Main Business Indicators of Oil and Gas Improvement Projects

Investment and cost are effectively controlled, and the benefit indicators are better than the

planning. There are two key points in oilfield improvement project decision-making: scale and benefit. How to achieve a balance between the two depends on the improvement environment of the enterprise. Under the conditions of high oil prices and low policy constraints, appropriate expansion of the scale of various types of projects at all levels is beneficial to the rapid improvement of the oilfield. Under the conditions of low oil prices and high policy constraints, the scale is appropriately limited to highlight benefits, which is more conducive to the steady improvement of the oilfield. The four-year main operating index data of M oilfield from 2018 to 2021 are shown in Table 3 and Figure 2:

Table 3. Comparison of main Management index of 2018-2021

Project	Planning of 4 years	Reality of 4 years
Total investment (RMB 100 million)	304.1	202.4
Total cost (RMB 100 million)	253.2	224.3
Operating cost (yuan-ton)	1040	1405
Oil steam ratio	0.247	0.196
Total revenue (RMB 100 million)	184.8	287.1
Pre-tax profit (RMB 100 million)	-8.4	94.7
Net profit (RMB 100 million)	0	84

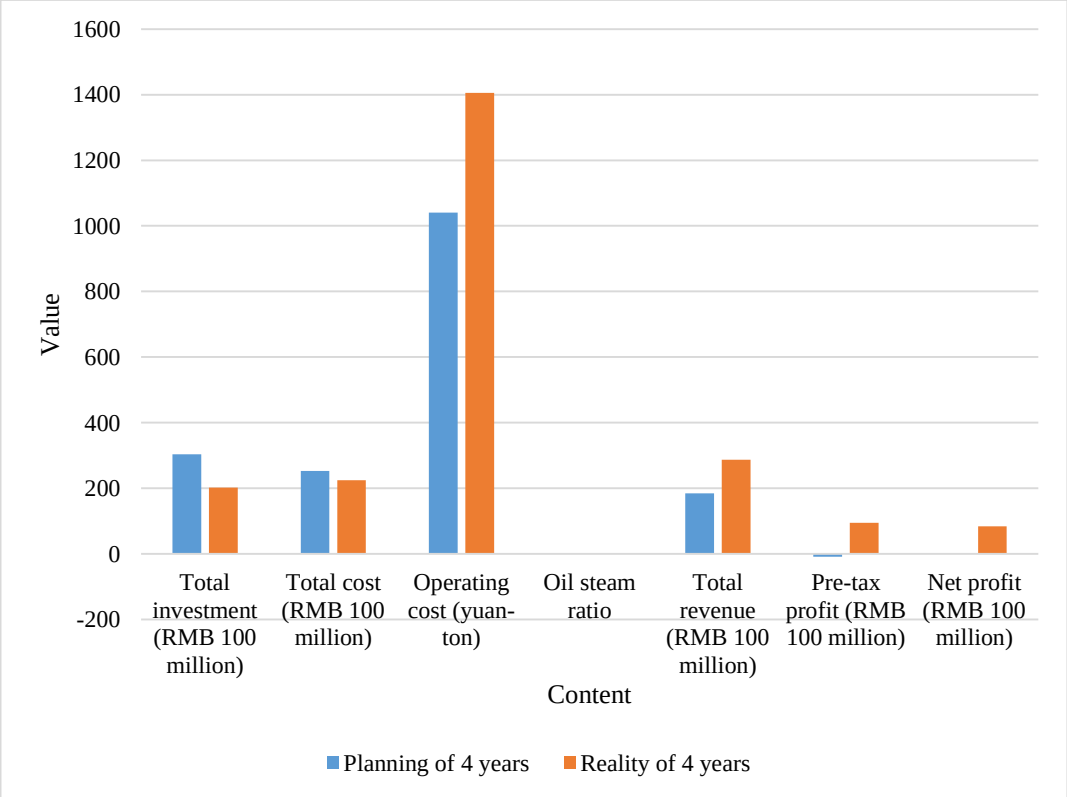

Figure 2. Comparison chart of business index data

The data show that through optimizing the production organization and operation, the actual total cost in four years is 22.43 billion yuan, which is 25.32 billion yuan higher than the planned total cost. Thanks to the high oil price, the improvement benefit index of M oilfield is better than the

planning and design. Since the operation of the project, as of November 2021, the international oil price has been running at a high level. The actual settlement oil price of M oilfield has been close to US $92 / barrel on average for four years, which is higher than the estimated oil price of US $71 / barrel in the plan. Therefore, the accumulated net profit in four years is 8.42 billion yuan, and the profit and benefit objectives exceed the planning expectations.

5. Conclusion

Project improvement requires in-depth understanding of the investment potential, economy and risk of the project. Comprehensive evaluation of oil and gas improvement projects is an indispensable link in the whole process of oil and gas improvement projects, and plays a very important role in the smooth implementation of oil and gas projects. And decision-making is the primary link of project construction. The quality of decision-making directly determines the quality of project construction. The saving of decision-making is the greatest saving, and the success of decision-making is also the greatest success of the project. The decision-making technology itself is mature, and there is still great room for improvement in the application of oil field improvement projects. How to make it procedural, standardized and scientific in the specific environment of the oil field is a problem that every decision-maker or decision-making participant must consider. It is a very important work for the whole project to establish an index evaluation system for the project and comprehensively evaluate the project.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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