Study on Incentive Cooperation Mode of Petroleum Engineering from the Perspective of Oil Company

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Abstract. The demands for cooperation between oil companies and oil service companies have undergone tremendous changes in the past few decades. In particular, on the basis of low oil prices, the two sides have gradually realized that only by strengthening cooperation and establishing a relationship of mutual trust, respect and incentives, can they achieve a win-win situation and promote the steady and healthy development of the oil industry. The purpose of this paper is to study the incentive cooperation mode between domestic and foreign oil companies and oil service companies in petroleum engineering management, and combined with the current situation of incentive cooperation mode in petroleum engineering of our country, this paper puts forward some suggestions on the cooperation mode between oil companies and oil service companies with the characteristics of coordination, win-win and incentive.

Keywords: cooperation mode; day rate incentive; production incentive; petroleum engineering management

1 Introduction

The contract is the ultimate embodiment of the cooperation mode. the so-called cooperation mode is the naming of the contract elements classified from different perspectives, and the understanding of the cooperation mode is formed by deconstructing the contract. The general contract mainly includes four parts: work content, contract objectives, organization and implementation, and fulfillment of incentives. The four parts have different ways of determination and execution, the combination of these ways form the contract, and the naming of the contract from different perspectives forms the cooperation mode.

Based on the deconstruction of the petroleum engineering contract, the petroleum engineering contract is divided into four parts, namely, the combination and management of the contract content, the determination of the contract objectives, the organization and implementation of the contract and the incentive mode. This paper focuses on the determination of contract objectives, the implementation organization and fulfillment of the contract, which are of great significance to the design of incentive model.

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Through the disassembly and analysis of the petroleum engineering contract, we realize that the so-called cooperation mode is a flexible combination by setting the contract objectives, determining the contract content and way of organization of implementation, and then adding the fulfillment of incentives. At the same time, the cooperation mode can be named according to different angles. From the perspective of contract content management, it can be named DBB mode, Boss mode, EPC mode, CM mode, etc. According to the way of organization and implementation, there are day-rate contract and boss mode. According to the incentive mode, it can be named BOT mode, output sharing, and buyback contract. According to the source of funds, it can be named PFI mode and PPP mode.

2 Incentive Cooperation Based on Contract Objectives

Objective setting provides oil companies with standards for objective discussion, monitoring and performance evaluation, and is the cornerstone of effective performance management. At present, the methods to determine the performance evaluation objectives of petroleum engineering in oil and gas industry are technical limit method, optimal value method and most likely value method. Different determination methods play different roles in evaluation.

Theoretically, the technical limit level is the best performance in the ideal case. The goal of the technology limit method is the best operation level that the existing technology can achieve. As shown in figure 1, the principle comes from Shell's “Drilling The Limit” (DTL). It first needs to understand what is needed for perfect completion, that is, the "limits" of current technology, and then pursue this perfection. At the same time, it also knows clearly that perfection is still impossible to fully achieve. DTL is used in most of Shell's wholly foreign-owned subsidiaries vs. equity joint ventures. Shell's subsidiaries around the world have used DTL to reduce drilling costs by an average of more than 20 per cent and cut drilling time in the UK by half. [1]

Encourage breakthroughs and strive to surpass the best level in history. Based on the best construction records in history, continuous breakthroughs are encouraged. Based on comparison with adjacent (or comparable) data, the time required to motivate contractors to continuously break records is predicted. The Petroleum Development Company of Oman (PDO) adopted this method before 1997. The method uses data from at least 3 adjacent wells as the standard, with a 5% growth rate as the target, and encourages contractors to achieve this target.

Classification of rewards and punishments based on historical data. Since 1997, Oman has implemented a hierarchical incentive system for drilling and completion projects. Taking the cost of per meter as the performance evaluation index, the target value of the cost of per meter is determined according to the rolling average of the cost in the previous three years. The rolling average of cost per meter is divided into five levels: target value interval, threshold critical value interval, interval below target value, interval above target value and optimal value. Those who exceed the target range will be rewarded, and those below the target range will be punished. Different types of wells have different spans.

The most likely value should be determined based on historical data and used as the basis for incentive evaluation. The way of determining the target is mainly based on the past construction data. For example, according to the actual production data of the same type of drilling in the same area for many years, the historical average method is used to determine the drilling cycle through statistical average. [2] The index value is regarded as a relatively reasonable reference value, which is usually used as a bid reference value. Here we consider it as the basis for incentive evaluation.

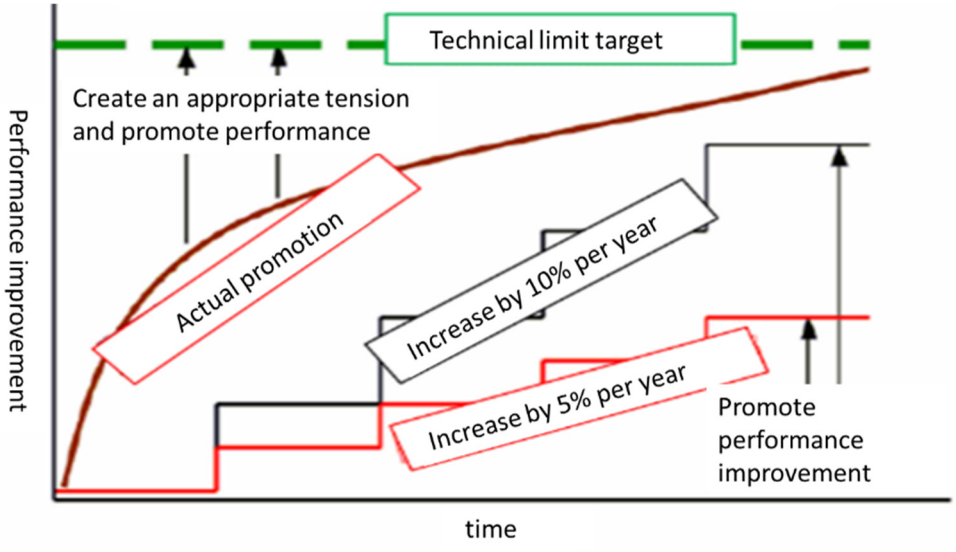

Fig. 1. Basic principle of application of limit drilling theory in management

3 Incentives Based on Fulfillment Methods

Additional contract incentives. The long-term cooperative relationship is conducive to the improvement of the degree of coordination between Party A and Party B, the accumulation of construction experience and the reduction of drilling costs, so many oil companies choose follow-up contract incentives to encourage drilling contractors. they give incentives to drilling companies with good early performance to extend the duration of the contract. Abu Dhabi National Oil Company has its own drilling construction team, which uses the day rate and workload incentive method in its management. They regularly monitor performance indicators, and the work assignment for the next cycle is based on the performance of the previous cycle, allocating more workload to teams with good performance[3].

Day rate incentives. Day rate incentive is to implement a specific level of daily fee standard for work content that meets specific requirements. Ocean drilling has used incentive-type day rate contracts. The framework of incentive day rate contracts is roughly the same as that of standard day rate contracts. During the construction process,

the contractor can propose alternatives to the operator's plan. If the contractor's proposal is adopted and good results are achieved (shorter construction period or lower cost), the contractor will receive an additional incentive day rate. If no agreement is reached between the two parties, the operator's decision will always be regarded as final.

Saving cycle incentives. The incentive of saving cycle means that if the drilling cycle is taken as the assessment index, and if the contractor completes the contents stipulated in the contract ahead of time, the contractor will be rewarded for the saved drilling cycle. For example, the single-well incentive mechanism of PetroChina during the Tarim Petroleum Campaign: For example, PetroChina's single-well incentive mechanism during the Tarim oil battle: 10% of the total daily drilling cost saved in advance of the construction period is given to the contracted drilling company, and 2% of the commission is used as the reward fund for the project team. If the assessment criteria are not completed, there is no commission and penalty for production awards. If the construction period is delayed, 30% of the management fees, profits and unforeseen fees shall be deducted according to the delayed construction period. The core of this incentive mechanism is to advance the well construction cycle and save the day rate to share the reward.

Production sharing incentives. The production sharing contract is an internationally accepted form of contract for foreign companies to invest in the development of oil and gas fields in the resource country. Drawing on the contract idea of production sharing can provide ideas for the incentive design of hard-to-use reserves. The level of production, that is, the risk of reserves and reservoirs, has a greater impact on benefits. Investors face the risk of not being able to fully recover the costs caused by the actual output being lower than the expected output, but they may also enjoy the excess profits brought about by the high output. [4] Low oil prices under the production-sharing model will also greatly affect the contractor's revenue. The production sharing contract still gives the contractor the opportunity to obtain a large amount of crude oil directly, which is quite attractive.

Buy-back contract incentives. The buy-back contract is actually a special form of project service contract. The contractor bears all project exploration and development expenses and technical services, recovers its capital expenditure and operating expenses from the product sales income, and they can withdraw a certain amount of profit. The core content of the buy-back contract mode is to determine the corresponding investment returns through contracted construction investment. Compared with the production sharing contract, the contract period of the buy-back contract is generally shorter, so it is difficult to obtain the income in the middle and late stages of oilfield development.

Production or product sharing incentives. Drawing on the ideas of production sharing contracts and buy-back contracts, production or product incentives are proposed. Party A and Party B negotiate to determine the output target, and Party A and Party B will share proportionately the part of the actual output that exceeds the target output. single-well measures are used to increase production, by eliminating the damage near the wellbore or establishing a structure with high conductivity in the formation, the output of the oil well will be increased, and the part that exceeds the expected target is

divided by both parties. [5] The block production is shared. After the block is produced, Party B will recover the investment, and the profit exceeding the recovery part will be shared by both parties through the contract. The amount, sequence and upper limit of cost recovery are the key points of the contract, and this mode is adopted in both Iraq and Angola.

4 The Influencing Factors of Incentive Cooperation Design

The essence of incentive cooperation in petroleum engineering is to select incentive points for incentive, and the design of incentive cooperation mode is restricted by the following factors.

First, it is related to the risk degree of drilling construction projects. In the day rate mode, the operator has all the decision-making power, which is helpful for the operator to control the drilling cost, progress and quality, grasp the first-hand data and information of drilling, and facilitate the popularization and application of new drilling technology. The second factor that affects the risk of a drilling project is the difficulty of drilling. The setting of performance indicators and the choice of organizational mode are set and selected according to the level of difficulty.

Second, it is related to the local resource allocation capacity of oil companies. The drilling construction process needs more professional coordination, and each link needs the support of the corresponding supply chain. If the local resource allocation capacity is not strong, it will lead to untimely supply of materials and equipment, and the purchase price will be too high. [6] Oil companies with strong resource allocation capacity will adopt the day rate contract system. When the oil service company has advantages in the allocation of local resources, the adoption of the contract system can make both sides complement each other and improve efficiency.

Third, it is restricted by the synergy between the various factors of performance management. If the goal of performance appraisal is to surpass the best in history or technical limits, the contractor will not be highly motivated when using boss mode for incentives. Due to the pursuit of the most advanced technology in the implementation of the project, most of the work is devoted to evaluating new technologies, so the implementation is difficult. In the design of the drilling performance management mode, it is necessary to ensure its enforceability and actual incentive effects.

5 Design of incentive cooperation mode in petroleum engineering

The petroleum technology service industry in our country has the characteristics of large scale, high investment, high risk, and complex construction process. The size of petroleum technical service capacity, the level of efficiency, and the level of petroleum engineering project management have become the important aspects to measure the overall competitiveness of a petroleum enterprise. The innovation of the cooperation

mode will bring obvious effects to oil companies in reducing costs and increasing efficiency. This research proposes 5 types of incentive cooperation modes for petroleum engineering.

The day rate incentive cooperation mode with the goal of pursuing the technological limit are shown in Fig2. The organization mode is the day rate, and the goal of the mode is to grasp the data of the new area, pursue the technical limit, find and apply new technology, and form the block benchmarking. The incentive point is to feedback construction data, improve operation efficiency and put forward suggestions. Scope of application: exploration wells in new areas, drilling in areas with bad environment, ultra-deep wells with complex geological conditions and high engineering risks.

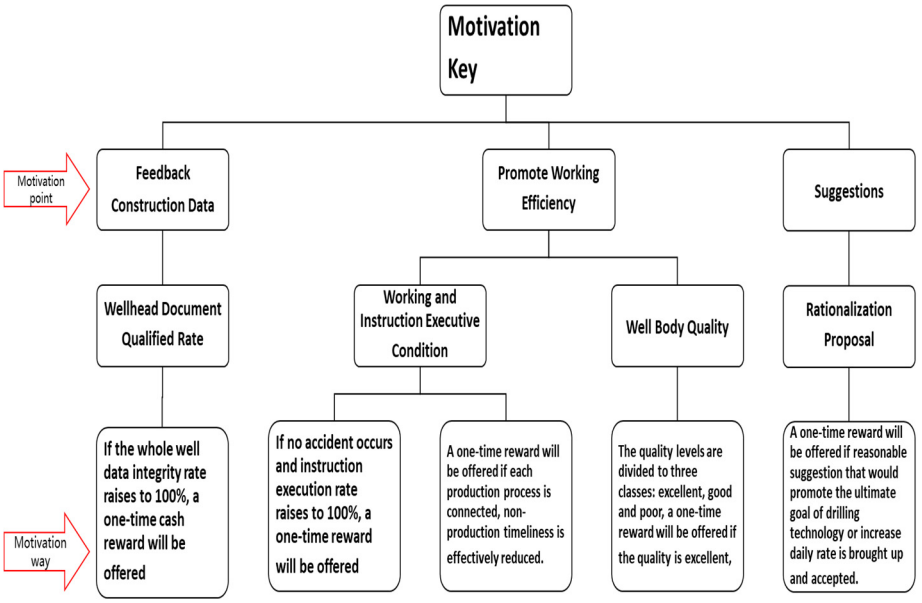

Fig. 2. Incentive cooperation mode

6 Conclusions and Suggestions

The contract is the ultimate embodiment of the cooperation model. The so-called cooperation mode is the naming of the classification of contract elements from different perspectives. This study forms the understanding of the cooperation model by deconstructing the contract. From the point of view of the oil company, this paper puts forward five suggestions for the development and optimization of the cooperation modes in petroleum engineering, such as “the day rate incentive cooperation mode which is

suitable for drilling in the new area to pursue the technical limit", "the contract incentive cooperation mode which is suitable for the development well to pursue the continuous improvement of performance", "contract incentive cooperation mode suitable for increasing production in old areas with the goal of pursuing production", "buyback mode suitable for difficult-to-produce reserves" and "joint venture cooperation mode suitable for areas with low degree of exploration and difficult-to-produce reserves". According to the different incentive points, the cooperation mode of petroleum engineering will change. For example, the equity incentive of the joint venture mode is also the direction of cooperation between oil companies and oil engineering companies in the future.

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