



Analysis of the Problems and Countermeasures in the Petroleum Material Supply Chain under the “Oil Company” Model

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Abstract

In order to adapt to the needs of energy transformation and competition, the "oil company" model has generally been introduced and vigorously implemented in Chinese petroleum enterprises, which has put forward higher requirements for the efficiency and quality of the petroleum material supply chain. Combining with the characteristics of the petroleum material supply chain, this paper analyzes the current situation of the supply chain of petroleum material enterprises, mainly analyzes the problems existing in the five key business links of material planning, material procurement, material quality control, storage and distribution and information system, and puts forward corresponding countermeasures, so as to solve the problems existing in the supply chain of petroleum materials enterprise in China. To realize the high efficiency and integration of the petroleum material supply chain, promote the further development of the petroleum material supply chain under the "oil company" model and more effectively guarantee the national energy security.

Keywords

The "oil company" model, Petroleum material supply chain, Existing problem; Improvement countermeasure

Introduction

With the intensification of competition among international oil companies, reducing cost and improving efficiency have become a critical issue that the Chinese oil industry must face. Since the introduction of the "oil company" model in China, various petroleum enterprises have carried out a large number of reforms in organizational structure, core business, marketization, projectization, informatization and other aspects with the main goal of improving efficiency, benefit and increasing core competitiveness.

The petroleum material supply chain is an essential guarantee link for the stable production and safety of the oil and gas industry. Its key businesses include planning, procurement, quality control, warehousing and distribution, etc., with heavy assets, high efficiency and quality requirements, and large cost ratio, it has also become the key content to promote the realization of the reform goal of "oil company". Therefore, under the background of the deepening reform of the "oil company" model, combining with the characteristics of the petroleum material supply chain, it is of great practical significance to discover the existing problems in the current situation and put forward corresponding countermeasures.

asures for improving the efficiency of the petroleum material supply chain.

1. Analysis of the current situation of the petroleum material supply chain under the "oil company" model

1.1 Characteristics of the petroleum material supply chain

Due to the large production scale, complex operation and high technology intensity of the petroleum industry, the petroleum material supply chain also has typical characteristics different from other industries.

(1) High degree of complexity

On the one hand, the oil industry needs numerous kinds of materials, varieties, miscellaneous models and great differences in attributes. Materials are classified by use, including drilling engineering, surface construction, capital construction projects, auxiliary support, production and maintenance, scientific research support, living materials, etc (Gao, Wang, & Liu, 2020). According to the attributes of materials, there are various categories, middle categories and tiny categories. Each variety is divided into several specifications and different attribute values, which makes it difficult to manage materials and code materials. On the other hand, the petroleum material supply chain not only includes suppliers, demand units, procurement departments and additional roles, but also includes multiple suppliers, many work links, and a great degree of management complexity.

(2) Strict safety requirements

In petroleum materials, there are many materials and equipment with inflammable, explosive, highly toxic, radioactive and other characteristics, and most of the materials have to go through elevated temperature, extreme pressure and additional production processes in the process of use. In order to ensure the normal operation of production, it is necessary to closely require the materials and supply chain to have high safety, so as to ensure the safe operation of production activities of petroleum enterprises.

(3) Large amount of materials and high price

Oil production activities are deeply risky and are considerably affected by natural conditions, resources, technology and other factors. The slight shift of influencing factors may cause the change or adjustment of the production plan. Only sufficient materials can guarantee the normal production activities of petroleum, so the total amount of materials required by petroleum enterprises is large. At the same time, the oil industry needs to put in a lot of costly materials and equipment, such as tens of millions of dollars per unit of drilling machines, measurement-while-drilling equipment, etc.

(4) Lengthy response time of supply chain

The units in demand for petroleum materials are mostly located in remote areas with a wide distribution area, thus the petroleum materials must be transported to the units in demand after a lot of transportation, loading and unloading, storage, allocation, distribution and other work. There are numerous supply links, and the supply chain response time is slow.

1.2 Analysis of the typical framework and key business models of the petroleum material supply chain

Since the 1980s, the oil industry has been from the "battle" model to the "oil company" model reform. Various petroleum enterprises have carried out a great deal of reform in the supply chain of materials. In addition to improving organizational structure, a number of market-oriented and information reforms have been carried out in the planning, procurement, warehousing and other vital business links of material supply.

At the same time, to improve the supply chain level, most oil companies have established separate material supply management departments. At the same time, in the procurement of materials, the proportion of centralized procurement is also increased, the supply of materials is distributed in different areas, and the market mechanism of non-core business is adopted, which improves the overall efficiency of material supply to a certain extent.

At present, the typical frame diagram of the petroleum material supply chain is shown in Figure 1. Starting from material demand, the petroleum material supply chain is divided into three parts: the user of petroleum materials, the supply management department of petroleum materials and the supplier. These three parts are independent and coordinate with each other to jointly complete material planning, procurement, quality inspection, storage and other work, so as to realize the timely transmission of material supply and demand information flow, capital flow and logistics, and ensure the effective supply of materials.

To be specific, the current management mode of key business links in the supply chain of petroleum enterprises is as follows:

(1) The material plan adopts the mode of "centralized management, classified and graded responsibility". Material planning mainly includes demand planning and procurement planning. The material user shall compile the demand plan

according to the actual production and submit it to the material supply management department for examination and approval. The procurement plan shall be prepared after the examination and approval, and be implemented after the examination and approval step by step. Moreover, the preparation of material plan, audit, implementation of the whole process of inspection, guidance, supervision and evaluation.

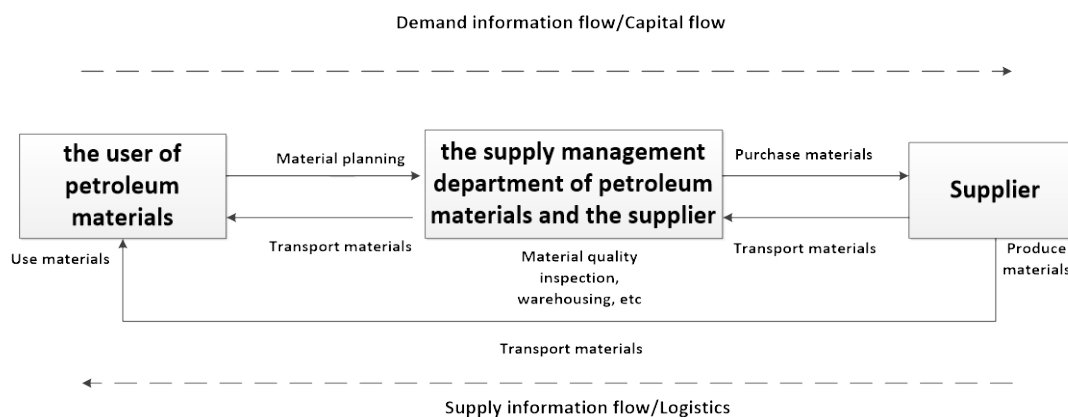


Figure 1. Typical frame diagram of the petroleum material supply chain under the "oil company" model.

(2) The procurement of materials shall adopt the mode of "unified management, separation of management and office, centralized procurement and hierarchical responsibility" (Zhang, 2018). The material purchase management information system is used for unified information management and procurement. In principle, the material purchasing unit is entrusted to carry out the implementation of procurement contract, quality inspection, acceptance payment and logistics in a unified manner; the administrative departments at the two levels organize and coordinate, supervise and inspect, and promote the quality and efficiency of material supply; in the case of urgent, sporadic and emergency materials procurement, hazardous chemicals procurement and other special circumstances, the material user may organize the procurement on its own.

(3) Quality control adopts the "whole process life cycle" mode. From the purchase of petroleum materials, to storage, and then to the final use of the whole process of strict quality inspection. Moreover, pay attention to strict quality inspection and control of critical key control nodes in the process, such as procurement plan (demand) quality control, procurement plan quality control, procurement contract quality control, manufacturer production process quality control, acceptance process quality control, warehousing and distribution process quality control and use process quality control.

(4) For warehousing and distribution, the mode of "centralized warehousing, regional sharing, direct delivery by manufacturers + warehousing and distribution" is implemented. Warehousing resources are planned as a whole, and flat warehousing management and warehousing resource sharing are promoted. The whole cycle management of warehousing mainly includes the management of various links, such as the arrival and transportation of materials, material acceptance, material warehousing, material storage, material storage and maintenance, material inventory, material delivery, financial management, project surplus material return, storage safety management, material reserve and quota, etc. Considering the quality control requirements and demand characteristics of materials, some materials are selected as direct delivery by manufacturers, that is, suppliers directly deliver materials to the enterprise demand site; part of the materials shall be stored and distributed, that is, the suppliers shall transport the materials to the warehouses of the petroleum enterprises for living, and then the petroleum enterprises shall distribute the materials according to their internal use needs.

(5) The material information system shall implement unified construction and management. The material information system of most petroleum enterprises includes electronic procurement system, electronic bidding and bidding platform, ERP system and other material supply related function modules, which support the basic demand of the business system of material supply.

2. Problems existing in the petroleum material supply chain under the "oil company" model

2.1 Poor standardization of material plan filling

Many petroleum enterprises have poor standardization in the reporting of demand plans. On the one hand, the

planned purchase quantity of part of the demand is less and the number of submissions is additional; while there are more temporary emergency demands, there is also a problem that some material demand planning time is long in advance. On the other hand, the elements in the demand plan are incomplete and standardized, resulting in difficulties in the execution of the contract and the procurement of materials do not meet the needs of the problem.

2.2 Insufficient feedback and supervision on suppliers

After purchasing suppliers, most petroleum enterprises do not strictly evaluate the performance of their contracts in the internal contract system. Moreover, the reporting process is complicated, which leads to fixed suppliers and without adjustment. At the same time, the collection and application of supplier information is insufficient, which also makes the call of supplier information not convenient and complete enough, thus affecting the accuracy of supplier evaluation and supervision.

2.3 Large warehousing scale, slow turnover and low distribution efficiency

At present, the problem of supply chain storage in petroleum enterprises is mainly the problem of storage space. First, in order to supply materials in time to ensure stable production, the "bullwhip effect" frequently occurs, which makes the material reserve scale large and the inventory turnover rate significantly reduced. Second, the actual demand data of materials is usually inconsistent with the plan, resulting in idle materials dull too much, occupying inventory space; however, most storage units pay insufficient attention to and assess the storage cost of service units, which additionally promotes the inventory scale. In addition, for the manufacturers of warehousing and distribution resources planning insufficient utilization, manufacturers' direct delivery ratio is low; in terms of the delivery of warehousing materials, the professionalism is not strong, and the socialized vehicles are more random, which affects the efficiency and quality of delivery services.

2.4 Too large quality control and testing links, high costs

Due to the excessive quality supervision and testing process of petroleum materials, the standard content is complex, which may lead to repeated testing or unreasonable testing, thus affecting the cost and efficiency of the overall supply process. At present, there are still many testing links for conventional materials in Chinese petroleum enterprises, which not only pushes up the cost of quality inspection, but also affects the efficiency of material supply to a certain extent.

2.5 Interconnection difficulties in internal information systems

Affected by historical reasons, most oil enterprises have multiple information systems of unified construction and self-construction. Among them, the problems of information isolated island such as insufficient information exchange and interaction, untimely data sharing and offline information processing workload are prominent. There are information barriers between oil enterprises and suppliers, as well as internal departments of the enterprise. The lack of information system through the whole process of material supply chain is not adequate to support a more efficient professional material support system.

3. Improvement measures of the petroleum material supply chain under the "oil company" model

3.1 Improving the Management and Supervision System for Material Planning

Develop a sound material planning system, and clearly specify the filling and application procedures of various types of material plans. To fill in non-standard, incomplete elements of the material plan back, and the relevant person in charge of education, strictly standardize the material plan filling. At the same time, improve the material supervision system and strengthen supervision. Focus on the supervision of material plan declaration, approval and additional links, and strictly assess the accuracy and timeliness of material plan. Keep the continuous tracking and supervision of the implementation of the material plan of each unit (Shen, 2016).

3.2 Improving the dynamic assessment system for purchasing suppliers

Petroleum enterprises should improve the Supplier Evaluation Standard, perfect the dynamic evaluation system of purchasing suppliers, carry out regular and dynamic comprehensive evaluation on suppliers in terms of bidding and quotation, quality and service, delivery and acceptance, settlement and payment, clean government construction and other aspects, publicly release the evaluation results, and regularly eliminate suppliers with poor evaluation. Improving

suppliers' supply quality and service awareness (Zhou, 2022). Petroleum enterprises can leverage public credit information and improve supplier data to achieve more accurate supplier portrait and database, leading to long-term stable supplier selection and assisting the daily decision-making by purchasing personnel.

3.3 Strengthening the management of material warehousing and distribution

Strengthening the management of material storage and distribution should be carried out from five aspects: first, continuous cleaning of idle materials; second, quick disposal of discarded materials and periodic zeroing; thirdly, collect inventory data and analyze inventory structure on a regular basis, monitor inventory structure, urge related production units to take goods and include the assessment results in their settlement costs; fourth, strengthen the use of market resources, improve the proportion of manufacturers' direct delivery, in order to reduce inventory and distribution costs; fifth, integrate high-quality third-party logistics and deepen cooperation, improve the marketization level and supervision intensity of warehousing materials distribution vehicles, and enhance the professional level of distribution.

3.4 Strengthening the overall management of supply chain quality control and improve quality inspection efficiency

Use the latest generation of Internet technology to establish the supply chain quality control digital system. Through the system remote real-time interconnection, on-site online supervision and inspection monitoring and other interactive ways, we jointly develop and establish an online quality control system with suppliers and manufacturers, and upload a variety of quality control management information data such as manufacturer self-inspection, on-site supervision and third-party testing into the system in real time, realizing information communication and sharing among suppliers, petroleum enterprises and other parties. Reduce repeated inspection by providing timely online data feedback. At the same time, all the main businesses are connected to the supply chain quality control digital system, all business processes are sorted out, and processes such as material and product sampling, supervision and inspection, and report issuance are optimized, and quality control plans are scientifically formulated according to the characteristics of various materials. Reducing unreasonable quality inspection (Jiang, 2022).

3.5 Improving the standardization and sharing scope of information systems

Unimpeded information flow is an essential way for efficient operation of the petroleum supply chain. The information flow of efficient petroleum materials should start from two aspects: standardization and sharing. On the one hand, petroleum materials enterprises should integrate internal information systems in time to realize data communication and sharing, reduce information asymmetry and repeated input problems; on the other hand, material enterprises should also establish interfaces to share and update the key information about the demand and supply of service units and upstream suppliers, including the production, storage and distribution of the supplied materials, so as to realize the information integration of the whole chain of petroleum materials from demand planning to procurement, production and finally to material delivery.

4. Conclusion

In general, with the deepening of the reform of the "oil company" model, improving the efficiency of the petroleum material supply chain has become the key and main way for enterprises to reduce costs and increase efficiency. At present, China's petroleum material supply chain has carried out a lot of reforms, but there are still problems of high cost and low efficiency in planning, procurement, storage and distribution and other major business links. The supply chain for petroleum materials has been substantially reformed, but there are still high costs and inefficient problems in planning, procurement, warehousing and distribution. There is still a big gap between Chinese oil enterprises and international excellent oil enterprises. All petroleum material enterprises need to further pay attention to the core business, refine management content and links, strengthen process supervision and assessment and timely feedback, fully integrate market-oriented resources, open up internal and external information and smooth communication and decision-making channels, in order to achieve high efficiency and integration of the petroleum material supply chain, finally improve benefit of the enterprise, help petroleum enterprises enhance core competitiveness and ensure national energy security.

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