

Research on the data collection standardization system of capacity construction report in changqing oilfield

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Abstract. The capacity construction project group of Changqing oilfield needs to repeatedly enter the same data into multiple different information systems of the company every day. This work mode causes many problems, such as multiple entries, heavy repetitive workload, and difficult to guarantee data quality. Through in-depth analysis of business process and data entry status of the capacity construction project group, this paper puts forward the working ideas of data collection link standardization and data collection standard standardization, explores and establishes a standardized data collection system for the whole chain of capacity construction report data, including investment plan, well information entry, investment allocation, predrilling, drilling, well log, logging, oil testing (gas testing), production and injection, and well delivery. The system guarantees the timeliness, integrity and accuracy of data. In addition, it provides an external data sharing service, build the capacity construction data sharing platform, and realize the "one-time data entry, multiple system reuse, automatic report generation" of capacity construction report data.

1 Introduction

Changqing Oilfield proposed the strategic deployment of "accelerating development for the second time" in 2018, and the exploration and development data is the basis for the oilfield to rapidly increase and stabilize production. Focusing on the exploration, evaluation and productivity construction of oil and gas fields, on the one hand, the production capacity project group has specially assigned personnel to collect well site construction data every day and prepare daily reports of drilling, oil testing/gas capacity construction in Excel format, which are distributed to relevant scientific researchers by telephone or email to support daily scientific research and production. On the other hand, the capacity construction project group also needs to input the drilling and oil/gas testing data into the information system of multiple functional management departments. The repeated workload is heavy, and multiple entries lead to inconsistent data among systems.

How to open up the information channel of indoor research and on-site operation, simplify the on-site work mode, and effectively manage the production report data between the on-site project group and the functional management department has become an urgent problem to be solved^[1].

By means of digitalization, this paper combs the data flow model according to the business process of the capacity construction project group, builds a standardized collection system for production construction report data, opens up the information channel for indoor research and on-site operations, integrates and processes, uniformly

submits, integrates and shares the data filled in by the project group, reduces the tabulation and repeated entry work of the project group, and finally establishes a flexible and flat organization mode, promote the oil and gas exploration, evaluation and productivity construction of Changqing Oilfield to achieve a win-win result^{[2][3]}.

2 Work flow analysis of the project group

According to the field survey results, the data collection business process of the capacity construction report of the project group can be divided into two types: one is the exploration and evaluation project group based on single well, and the other is the oilfield and gas field productivity construction project group based on the investment classification, with well group as the object^[4]. This paper analyzes and sorts out a comprehensive production report data model by studying the data status, business process, data report, data processing and reporting information of the project group.

2.1 A Subsection Sample

The business process of the exploration and evaluation project group can be divided into 8 business stages: well information entry, predrilling, drilling, well log, logging, completion, oil/gas testing. The oilfield production capacity project group has added investment plan, investment allocation and other information to the exploration and evaluation project group, which is divided into 11 business

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stages: investment plan, well information entry, investment allocation, predrilling, drilling, well log, logging, well completion, oil testing, production and injection, well delivery. The gas field production capacity project group is the same as the oil field production capacity project group, with a total of 11 business stages^[5].

2.2 Data entry status

According to statistics, the information systems that each project group needs to fill in daily data include the A1 and A5 systems built by the CNPC (China National Petroleum Corporation), the exploration and production management system, the engineering information management system and the operation command emergency management system built by the Changqing oilfield itself. For each well, the project group needs to repeatedly input about 140 items of data in six categories, including basic well information, predrilling, drilling, and daily oil/gas testing in each set of information system.

The survey found that although each system has made targeted rule restrictions on the collection of some fields, it has not established a comprehensive data collection specification, resulting in uneven data quality within the system, great difficulty in sharing, and difficult to be effectively applied.

3 Construction of data acquisition standardization system

This paper aims to reduce the daily workload of the project group and improve the quality of capacity construction data acquisition of the oilfield company. Based on the actual production organization of oil and gas exploration, evaluation and production capacity construction, it builds a real-time link of production data in the way of operation chain, realizes the standardized entry and management of basic information of each business node, automatically generates various reports required by the project group, and creates an enterprise level core resource pool of capacity construction data^[6].

3.1 Acquisition link standardization

According to the demand analysis and the division of user application levels, the data acquisition process consists of 11 data link nodes, including investment plan, well information entry, investment allocation, predrilling, drilling, logging, well completion, oil testing or gas testing, production and injection, and well delivery^{[7][8]}.

The investment plan and investment allocation node are used by the oilfield capacity construction project group to collect the annual deployment of the company's oilfield capacity construction, and manage the investment unit included in the investment plan and the single well information included in the investment unit; The well information entry node is used by scientific researchers to distribute the target well location information of the current year to different project groups according to different types. Through the well information entry function, the unique identification of a single well is established, which

is the basis for data association and sharing between different systems; The predrilling node collects the predrilling construction unit, block, geographic location and other information contained in the predrilling weekly report, updates the predrilling status of single wells, survey and re survey coordinates, well site information, etc., and generates the predrilling weekly report of the project group, the land outsourcing weekly report and other reports; The drilling node collects the working conditions of the drilling team and the drilling dynamic data of the single well every day, and generates the daily drilling report of the project group; The logging node collects all kinds of achievements and data collected by the field logging crew, and directly imports them into the analysis and warehousing management through the standardized data template, thus avoiding various errors easily caused by manual entry; The oil/gas testing node shall collect the daily work of the oil/gas testing construction team, as well as the oil/gas testing layer, production and result data of a single well, and generate the daily oil/gas testing report of the project group; The production and injection node provides the project group with functions such as production and injection data query, new production well query, and new well production tracking, and generates comprehensive reports such as capacity construction weekly reports; The well delivery node provides well status change management for the remaining wells and the wells implemented in advance.

3.2 Collection specification standardization

According to various reports made by the project group and the data application needs of different information systems, on the basis of the standardization of the acquisition link, the logical association between business flow and data flow is established to realize the production work mode similar to the industrial assembly line, achieve the unification of business flow and data flow. At the same time, the standardized data acquisition specifications are formulated for the predrilling, drilling, oil/gas testing and other process nodes to ensure the timely, complete and accurate warehousing of data.

Circulation Standardization

The flow of data on the standardized link should follow the actual on-site workflow. Here we take the acquisition of Well A data in the oilfield productivity construction business stage as an example. At the beginning of the year, the investment plan and investment unit of the year were determined according to the company's annual capacity construction deployment table. After Well A is saved into the database through the well information entry node, it must be associated with the investment unit to determine the implementation project team of Well A. Then it is transferred to the predrilling node, where the well site information of the project group is maintained, and Well A is associated with the well site. After the association is completed, it is transferred to the drilling node. Daily drilling data shall be entered at the drilling node until Well A is completed, and then transferred to the well testing node. Daily data of well testing shall be entered at the well testing node until well A is tested. Well A must meet the

above corresponding conditions to automatically transfer between different nodes of the data link, so as to avoid missing key data at the data link level.

Input specification standardization

Basic well information is the first step of the standardized data acquisition system. In terms of data entry specifications, different acquisition scopes are formulated for exploration, evaluation, oilfield capacity construction and gas field capacity construction (Table 1).

Table 1. Data entry specification issued by well information entry [drawn by the author]

Business Phase	Common data items	Special data items
Exploration and evaluation	well name, wellhead design coordinates,	deployment year
Oilfield capacity construction	target design coordinates, target layer, well type, well purpose, organization, block, design horizontal section length,	unit, coordinate classification, distribution basis
Gas field capacity construction	kelly bushing, ground elevation	coordinate status, well group

The daily drilling data supports the preparation of the daily production report of the Changqing oilfield company, and also involves the construction unit's workload settlement

and other key businesses, so the standardized data entry process must be adopted (See Fig.1).

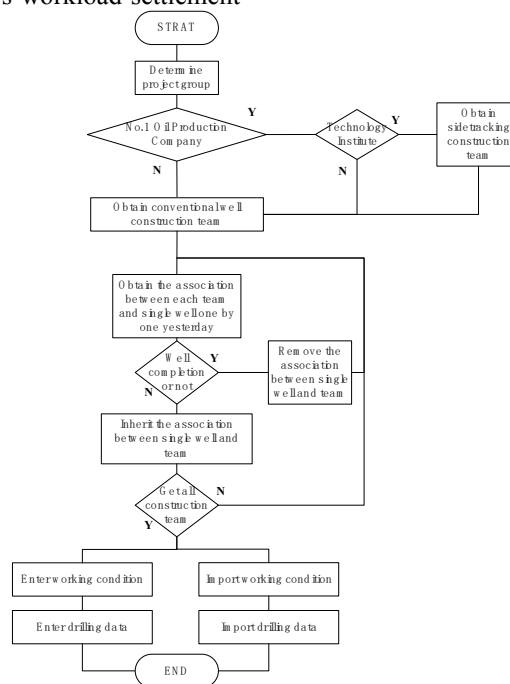


Fig. 1. Standardized acquisition process of daily drilling data [drawn by the author]

According to the actual business of the construction site, the standardized input specifications are formulated to ensure the integrity of data (Table 2).

Table 2. Data entry standard of daily drilling report [drawn by the author]

Data	Data entry standard
Construction team	Each team must have work content every day.
	The same team cannot work at different well sites at the same time.
	One team can only be associated with one well site at a time. No more than 4 construction teams are allowed in one well site at the same time.
Daily report data	When the drilling rig status is in the process of drilling, the actual well depth and the formation reached must be filled in.
	When the drilling rig status is completed, the measured coordinates and casing data must be filled in.
	In case of backfilling due to geological reasons, the footage in the backfilling stage shall be included in the total footage

In case of backfilling due to engineering reasons, the footage in the backfilling phase shall not be included in the total footage

The data entry standard in the oil and gas testing stage is similar to that in the drilling stage. Through the above standardized data flow and collection specifications, the core data management in the capacity construction process is effectively guaranteed.

4 Capacity construction report data sharing service

Based on the standardized data collection system of capacity construction report, the real-time report system of capacity construction is developed. The system runs in the mode of job chain node. Through data inheritance, batch update, document analysis and other technologies, the workload of data entry of project group staff is minimized, and various reports required by the project group, research departments and functional management departments can be quickly generated, changing the previous tedious and inefficient working mode.

All data collected by the system, through the external data sharing service, provide well information, drilling, oil testing, gas testing and other six types of data for multiple information systems built by the group and independently built by the oilfield. Each well can reduce the repeated input of more than 140 items of data, about 92.6% of the input workload, and realize the "one-time data entry, multiple system reuse, automatic report generation" of capacity construction report data^[9]. In 2021, more than 500 reports have been generated and more than 11000 data sharing services have been provided.

5 Conclusion

The capacity construction report data is the core to master the implementation progress of the company's investment deployment, the implementation effect of drilling design and the site construction dynamics. The standardized collection system of capacity construction report data starts from the actual work process of the project group, through the principle of unifying business flow and data flow, creates a complete data collection link, formulates data flow and collection specifications, ensures the timely, complete and accurate storage of data, and realizes the centralized management and effective application of intangible assets like capacity construction report.

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