Digital Oil and Gas Field in China and its Development

Wenbo Zhang, Zhiliang Gao, Qian Gao and Yuan Li

ABSTRACT

The digital oil field was blooming and producing plentiful results in China since Daqing oil field putted forward it in 1999. Taking "Digital Oilfield in China" as the research objective, the future development trend of the digital oil fields is discussed by author through analyzing and evaluating the concept, position, definition and the present situation of China's Construction. The purpose is dedicating the digital and intelligent construction of China's oil and gas fields to the world.¹

INTRODUCTION

As a brand new concept, digital oilfield was proposed in twenty-first Century. It provides innovative management methods and digital oil and gas field models for China's oil and gas fields.

THE CONCEPT OF DIGITAL OIL FIELD IN CHINA AND RESEARCH SIGNIFICANCE

“Digital oil field in China”, which is the name of monograph, also is the objective of our research.

1) Concept. “Digital oil field in China” means as making digital and intelligent

¹Wenbo Zhang. Digital Oilfield Institute of Chang’an University, Earth Science and Resources School of Chang’an University
Zhiliang Gao. Digital Oilfield Institute of Chang’an University
Qian Gao. Digital Oilfield Institute of Chang’an University, Environmental Science and Engineering School of Chang’an University
Yuan Li. Digital Oilfield Institute of Chang’an University
construction for oil and gas field in China, which purpose is promoting the development of digital oil field in China.

2) Research. There are three main things to be researched in the study of “Digital oil field in China”.

First is tracking research. The construction of digital oilfield in China is objectively analyzed and discussed in the series books of "digital oil field in China", which had been published four books in the past ten years. The last book is expected to be published in 2019, at that time, the theoretical system is completed.

Second is technology research with standardization establishment. The general map of the construction of digital oil field has been compiled, and various standards and roadmaps are designed and established. Finally, a complete set of technical systems has been formed, including Datist (data scientist), Wellist (oil-well scientist), Resrst (Reservoir scientist), B-datist (Big data scientist) and other technology achievements, all of these systems were expected to play the roles of experts

Third is building a communication platform. We have held five times (Biennial conference) International Conference on digital oil field in China since 2009.

3) Significance. Mainly in the following points:

(1) Digital oil field in China, pioneered the development of oil field of China in twenty-first Century. Digital oil field, as the most advanced concept in the oil industry, has created a Chinese model of construction and operation management of oil and gas fields in the beginning of twenty-first Century.

(2) Digital oil field in China, the most advanced technology system of oil and gas fields has been created. The digital oilfield represents advanced ideas and technologies, which is integration the traditional technology with the digital and intelligent technology in oil and gas fields and supply the services to the oil and Digital oil field in China, a new management innovation model of oil and gas field in China has been formed. By means of digitalization and intellectualization, innovative development have been implemented on oil and gas field management, operation model and profit model.

This is the greatest significance with the construction and development of digital oil and gas fields in China in the past 10 years.

THE CONSTRUCTION STAGES AND EFFECTS OF DIGITAL OIL FIELD IN CHINA

Digital oilfield has made considerable progresses and good results since 1999, which lasted for nearly 20 years.

1) Division of construction stages

As a new thing, digital oil field can be divided into three stages.

The first stage, can be marked by data sharing and focus on paper data access to the computer from 1999 to 2008, at that time the concept of digital oilfield was proposed. On the one hand, at the theoretical level, the question what is digital
oilfield was debated intensely, on the other hand, in construction, three things have been done:

First, popularizing learning computer operation is aimed at speeding up the construction of information technology. Second, the construction of data sharing through the Internet has accelerated the paperless office at this stage. Finally, the former paper data has been digitalized. 80% of the documents have been digitalized by all oil and gas fields, which are spent more than 5 years. At the technical level, digital technology has matured in the process of inoculation.

The second stage is the digital management of oil and gas fields, with emphasis on the construction of digitalized, from 2007 to 2015, the most typical example is "Digital Oilfield management" in Changqing Oilfield.

In the construction of "digital management of oil field" in Changqing Oilfield, the sensor is the node, the multi-purpose is the center, the network is constructed by communication technology, which build a new model of the Internet of things in oil and gas field. The system consists of the front end, the middle end and the back end. The main task of the front end is to collect data and network construction; the main tasks of the middle end are command transfer and production management; the main tasks of the back end are data storage and management, and all kinds of management information application systems are built.

Therefore, referring to Changqing’s digital construction of oil and gas fields, the digitization construction of oil and gas fields has reached the peak in the national oil and gas field enterprises.

The third stage is the transformation and upgrading of digital oil and gas fields, and constructing intelligent oil and gas fields, the emphasis is on the construction of intelligent oil and gas fields, from 2015 to 2020. At this stage, the main task is to improve, standardize and upgrade the digitalization of oil and gas fields. A good infrastructure needs to be filled up and perfected, this process may need about 3-5 years to complete, some enterprises, who has better construction, have already started transformation and upgraded for building "intelligent oil and gas fields".

The above is a general division of the time period, which basically illustrates the construction process of digital oil field in China, and has achieved good results and effects.

2) The effectiveness of the construction
In general, these three points can be summed up.

(1) There is a qualitative leap in thinking and understanding. The digitalization of China's oil and gas fields has been created, and the digitalization of oil and gas fields has entered a new era. From proposing to concept, from concept to landing, from digitalization to transformation, people's understanding of Digital Oilfield in China has been continuously improved. Digital oil field has made great progress in oil and gas fields, which is the victory of ideological understanding of digital oilfield in China.

(2) Technically, a complete system has formed the digitalization of oil and gas fields. In China, the complete technical system for digitalization of oil and gas fields
has a main line, that is, “data acquisition, transmission, storage, management and utilization”. At present, in order to build intelligent oil and gas fields, the new technical system has been further put forward, which is “data acquisition, transmission, storage, management, utilization and intelligence”.

Therefore, in order to build digitalized and intelligent oil and gas fields, many advanced equipment and products have been researched and developed by many enterprises in China. At present, all kinds of intelligent robots have been on the job in gas stations, pipeline inspection and so on. A more intelligent future oil and gas field has been presented before us.

(3) In the construction of Chinese digital oil and gas fields, the new model has been created, explored and practiced constantly. This model is digital management and intelligent upgrading. At this stage, it is being implemented to "QHSE".

Q as abbreviation of Quality which covers all business and service in the digital and intelligent oil and gas fields, the traditional oil and gas field mechanism is completely changed by using the standard and intelligent technology for creating a new intelligent model. H as abbreviation of Health, that means people are the first valuable wealth, the ultimate goal of digital oil and gas fields is "unmanned oil and gas field", which is few people in the post, only Data scientists and scientists of oil and gas area. S as abbreviation of Security, there is no risk in the whole production process in the future when the oil and gas fields are very safe. E means Environmental protection, China is realizing the Chinese dream. Beautiful China contains beautiful cities, beautiful countryside and of course contains beautiful oil and gas fields. The future of oil and gas fields must be beautiful.

3) Evaluation of digital oil field in China

Digital oil field in China is a research topic, at present the evaluation of it can only be described as these points below.

(1) The creation of Digital Oilfield runs throughout the whole process of oil and gas field construction in China. To measure the value of an oil and gas field is the amount of oil and gas resources and production. So, what is the value of measuring a digital oilfield? It is to make the oil and gas field data value by using digital means and intelligent technology. This value is mainly reflected in the process of production and operation, in which the efficiency is improved with minimum manning, cut down cost and the increasing benefit. This is the value of oil and gas field after the construction of digital oilfield, which embodies the 1+1>2.

(2)Making the data great and making the data value fast. The essence of digital Oilfield in China is data construction, which is the process of generating the value of data fast. Data should not be acquired, transmission and storage, but should be much wiser. This progress is made up of the progress of digital, the progress of intelligent and the progress of making data valuable.

Digitalization is to comprehensively digitize oil and gas fields, including material, things, underground and underground, then a large number of data can be acquired. Intelligent oil and gas fields need data processing as the basic. Intelligentization is to carry out data analysis on the basis of digitalization,
complete the prediction and early warning, trend analysis, scientific decision, then sum up the knowledge-base and experience library for preparing for the analysis of large data and artificial intelligence. The progress of making data valuable is carrying out big-data analysis fast to benefit the oil and gas fields.

(3) Multiple commercial values are created in digital oilfield construction. Including hardware, software, system integration, construction team, operation with maintenance team, management team and other fields throughout the construction process of digital oilfield. In this progress, tens of millions of jobs or jobs have been increased, and the prosperity and development of the information market has been promoted.

Digital oil field in China, the digital intelligent oil and gas field has great potential in technology and role.

DEVELOPMENT OF DIGITAL OIL FIELD IN CHINA

History is the prelude for the future. The development of digital oil and gas fields in China is a historical necessity.

1）oil and gas fields is developing

Digital and intelligent oil and gas field construction is a great undertaking. No matter how the oil industry is, no matter how the oil and gas enterprises develop, Digital intelligence technology will be the main technology of future oil and gas fields.

Therefore, in China, the development of digital oil and gas fields will be necessary to promote the development of oil and gas fields.

2）digital oil and gas field is developing

Based on the principle of oil and gas field and the mechanism of digital intelligence, the development of digital oil and gas fields is illustrated below.

![The new model of oil field](image)

Figure 1. The development models of digital oilfield in China.
The development of digital oil and gas fields presents ladder shaped progressive. Digital oil and gas fields in China are upgrading from digitalization to intellectualization.

(2) From digital oil and gas fields to intelligent oil and gas fields, from intelligent oil and gas fields to wisdom oil and gas fields, the logical relationship is that a low stage must be infrastructure of the high stage. Without infrastructure, there will be no development at a high level.

(3) A wisdom oil and gas field is not a dream. Wisdom oil and gas fields are mainly integrated into human intelligence with oil and gas field operations and data intelligence technology, making intelligence to be the main technology.

3) The development of technology and model.

The final stage of digital oil and gas fields development must be wisdom oil and gas fields. The development process comes down to three main points. First, digital oil and gas field is a new thing, people need to develop it in research. Secondly, deep integration of digital intelligence technology is the reintegration of human intelligent for a complete technical system. Thirdly, we are responding to the "the Belt and Road" initiatives of the Chinese government, establishing the Wisdom Oil and Gas Field Brand (China) Technology Alliance. We want to gather all the fine enterprises with high quality technologies and products for setting up industrial parks, forming industrial clusters and building the best and largest intelligent oil and gas field "aircraft carrier". We can serve the whole world by using our own construction models of digital intelligent oil and gas field. Our slogan is "providing China's construction plan and contributing to the wisdom of China's development".

CONCLUSIONS

The above study can be concluded as below:

(1) “Digital oil field in China” is a research subject, aiming to study the digitalization, intelligent construction and development of oil and gas fields in China.

(2) In the process of building digital intelligent oil and gas fields, people continue to explore. From concept to implementation, digital intelligent oil and gas field construction have solved many "pain points" in oil and gas field enterprises in China, such as high cost, low efficiency, high risk, strong manual labor, complicated process, institutional mechanism and so on. This is a great change.

(3) Digital intelligent oil and gas field in China is evolving into a digital intelligent oil and gas field development model. The future of digital and intelligent of oil and gas fields development is wisdom oil and gas fields, which makes data great and the value of data can be generated fast.

In short, the research and development of digital oil and gas fields in China is heading for a bright future.
REFERENCES