



The Utilization of Information Technology for the Enhancement of Quality Supervision and Management Mode in Geological Survey Projects

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Abstract. This paper introduces the importance of using information technology to innovate the quality supervision and management mode of geological survey projects. The functional architecture of the online supervision and management system for project quality and the functional architecture and working process of the double random sampling system are described. The paper provides a comprehensive overview and analysis of the framework, practical application, and existing challenges pertaining to the online supervision and management mode for project quality. This mode is based on the quality reporting information system as well as the "double random and one public" supervision approach facilitated by the "double random and one public" information management system. It is pointed out that the establishment of quality supervision and management platform with information technology as a means can accurately, comprehensively and timely grasp the quality supervision information of geological survey projects, which will help to increase the supervision efforts on the quality behavior of the responsible subjects and quality supervision institutions of geological survey projects, significantly improve the supervision efficiency and level of geological survey project quality, and provide a scientific basis for project management decisions.

Keywords: information technology, innovate the quality supervision and management mode, geological survey projects, the quality reporting information system, the "double random and one public" information management system.

1 Introduction

The term "geological survey projects" refers to the geological surveys organized and implemented by the Geological Survey Bureau, funded by the central finance. These projects encompass various types of surveys, including basic geological survey, energy geological survey, mineral (non-energy) geological survey, hydraulic engineering environmental geological survey, marine geological survey, applied geological science research, strategic research on geology and minerals, as well as technological

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advancements in geological information. The primary objective is to conduct comprehensive surveys and evaluations that are fundamental, public-oriented and strategic in nature. This aims to provide a foundational database for the government's rational planning, management, protection and utilization of land and resources while offering society with public welfare information services related to land and resources.

Quality is the lifeline of geological survey work. The quality of geological survey results directly affects the level of geological survey work serving national economic and social development. The quality of geological survey project implementation stage is an important stage for the formation of the quality of final products. Whether the project can meet the required quality standards largely depends on the quality management level of the project implementation process. The quality supervision and management of the project implementation stage is the key to ensure and improve the project quality, and is the central link of the project quality management.

Information is an important way to achieve scientific management [1]. The construction of information management platform can realize the comprehensive informatization of geological survey project quality information from collection, storage, transmission, management and other links. Taking full advantage of information technology to innovate project quality supervision and management methods, establishing quality filling information system and "double random and one disclosure" information management system, can greatly improve the strength and efficiency of project quality supervision and management, and provide a scientific basis for project management decision-making. The informatization of quality supervision and management of geological survey projects is mainly based on computer technology and network technology [2]. It carries out unified management of quality information in the form of database, and uses the comprehensive information system of quality supervision and management to collect, manage, statistic and analyze quality data, so as to continuously improve the process quality control ability and quality management level, and provide a basis for decision-making.

The implementation of the online supervision and management mode of project quality, through the quality information reporting system, can timely grasp the quality of the project implementation process, and better evaluate, predict and control the management objectives. The double random sampling mode is adopted to improve the quality supervision mode. Through the "double random and one disclosure" management system, the inspection objects are randomly selected, the inspectors are randomly selected, and the sampling situation and investigation results are timely disclosed to the society, which can effectively improve the fairness, standardization and fairness of supervision.

2 Methods

The quality supervision information management platform is an operating system that can improve quality data and conduct centralized management. Through the use of B/S to combine the distributed structure, and build a set of quality management and

supervision of the network information platform between multiple project undertaking units [3].

2.1 Part One. Online Quality Supervision and Management Mode of Geological Survey Projects

I. General Thoughts.

The use of information means, the progress and quality of geological survey project online dynamic monitoring. Through the solidification of the process and control node, standardize the operation process, to achieve the work in accordance with the established rules in the online automatic flow, real-time online supervision and monitoring.

Through the filling, statistics and analysis of quality data, find quality hidden dangers and problem clues, strengthen quality risk warning, improve the ability and efficiency of online quality supervision [4]. To optimize the quality management process through information technology, unified management of quality data in the form of database, quality data collection, statistics and analysis, realize the collaborative operation of quality management and scientific analysis of quality data, make the collection and query of quality data more convenient, statistical analysis more rapid and accurate. Realize the project approval, implementation and achievement review of the quality management system document information control management mechanism, realize the standardization and process of project management [5].

II. System Function Architecture and Database Design.

◆The functional architecture of the project quality online supervision and management system includes the quality supervision business management module, the basic database management module, the comprehensive query management module, the macro decision-making statistical module, the system maintenance management module, and the data transmission management module. It mainly completes the online supervision registration, supervision task allocation, data transmission between quality supervision institutions at all levels, and the function of statistics, summary and analysis of various quality problems, forming supervision record form, rectification notice, punishment notice, bad record and other contents. The implementation of these services is mainly realized by filling in the web page [6].

◆Big data is an information asset with high capacity, high variability and high speed [7]. The direction of the future application of big data analysis is concentrated in two aspects: prediction and optimization [8]. Each project stage involves a large amount of data, and managers can control the overall progress and improve the quality of the project while making predictions and optimization[9].Project quality management is supported by big data technology as the core, with project quality and safety data services as the main line, and through the physical layer, knowledge layer, exchange layer, data layer and application layer to achieve the integrated system integration goal of "data, supervision and platform". The physical layer mainly realizes the compatibility and docking of system hardware and functional software in the qual-

ity management data system and other systems. The knowledge layer mainly matches and classifies the original data and shared data of project quality management, and provides source authentication, rapid acceptance and preprocessing for the service interface and data push of project quality management data at the data layer and exchange layer; the exchange layer mainly exchanges and shares the system data of project quality management with progress data, organizational data, cost data and human resource data on the platform [10].

2.2 Part Two."Double Random and One Open" Supervision Mode.

I. General Thoughts.

To change the management concept, improve the supervision mode, establish the "double random" sampling mechanism, take the geological survey project as the object, randomly select the inspection object, randomly appoint the inspection personnel, fully implement the "double random, one public" supervision, effectively improve the fairness, standardization and fairness of supervision [11]. Implement the "double random, one public" supervision mode, on the basis of fully considering the number of projects undertaken by the unit, the professional type of the project, the professional field of the expert and other principles, clearly define the basis of the sampling, the content of the sampling, the inspection standard, and the sampling method, to ensure the smooth operation of the random sampling function module of the supervision system. The key links are mainly as follows:

[Executive body] The centralized management department is responsible for the supervision and implementation of the "double random and one disclosure" of the centralized projects.

[List of random sampling projects] Random sampling of geological survey projects to achieve full coverage.

[Directory of experts] Establish a directory of experts in various professions to clarify the identity information of experts and publicize it. Dynamic adjustment with the change of experts' units, post adjustment and other factors.

[Directory of inspected objects] Establish a directory of units undertaking geological survey projects to be inspected according to the scope of responsibilities. Determine the frequency of random sampling to realize the retrieval and random sampling of projects by profession and class A and class B.

[Plan making] The centralized management departments shall submit the annual inspection plan at the beginning of each year, including the scope of inspected objects, the proportion and frequency of random sampling, and the time of inspection. The annual inspection plan shall be formulated to ensure the necessary coverage of inspected objects, the necessary supervision, and the prevention of excessive inspection.

[Random sampling of projects] A certain number of inspected projects are randomly selected according to the proportion through the random sampling system. In principle, the number of random sampling of the same unit in the same year shall not exceed 2 times.

[Random sampling of inspection experts] Inspectors are selected randomly from the inspection expert directory. Inspectors and inspected objects should abide by the principle of avoidance.

[Selection of sampling methods] The implementation of the annual inspection plan can adopt a directional or undirected sampling method. For professional supervision and inspection work, the method of directional sampling should be adopted in general, and the inspection objects should be selected by setting categories, or the qualifications and qualifications should be set at the same time to select expert inspectors.

[Determination of inspection results] The centralized management department should submit the inspection report within 20 working days after the quality inspection work is completed. The inspection report should include the inspection time, inspection content, inspection situation, and handling opinions and suggestions.

[Unified disclosure] The implementation of random sampling items should be disclosed regularly in the project supervision system.

II. Functional Architecture and Database Design of Double Random Sampling System.

The functions of the double random sampling system include the project library module, the quality inspector library module, the random sampling lottery module, the item list module, the record query module, and the information statistics module [12], among which:

- ◆ Project library module: the main function is to establish a directory of random sampling objects, including the name of the project and the name of the project undertaking unit, etc.

- ◆ Quality inspector library module: the main function is to establish a detailed, real and effective quality inspection expert directory.

- ◆ Random sampling lottery module: through the lottery and other ways, randomly select the inspection objects and inspectors from the directory.

- ◆ Item list module: the main function is to establish a list of random sampling items, make clear the sampling objects, sampling items, sampling subjects, sampling basis, sampling content and sampling methods, and publish them in time.

- ◆ Record query module: the main function is to query the historical information of the database in the system. It can be retrieved under different conditions to achieve the purpose of making traces and tracing responsibility.

- ◆ Information statistics module: the main function is to backup or restore the data of the internal database of the system, and at the same time classify and manage the digital information in the database, and present it in the form of graphics and charts, so as to quickly obtain information and understand the situation.

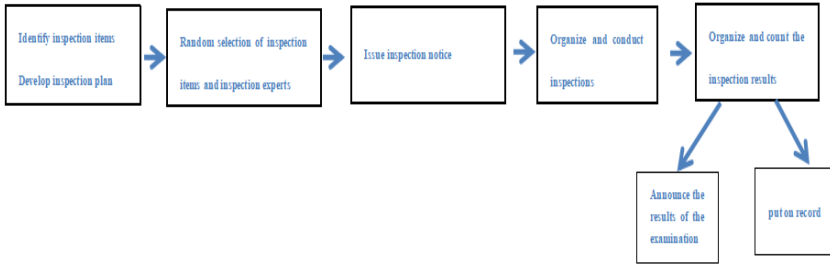


Fig. 1. "Double random one open" quality sampling flow chart

The specific "double random and one public" sampling process is shown in Figure 1:

Database design: the system construction includes basic data layer, application layer, presentation layer and access layer 4 levels.

- ◆basic data layer: project basic information database, project database, regional database, expert database, task database, key task database and technical data database, which constitute the data support for the operation of the whole system and dynamically update the data.

- ◆the application layer collects, sorts out and analyzes the data of the basic database based on the algorithm defined by the system integration and model database.

- ◆the presentation layer is the display window of the system function. Through text, graphics, tables and other forms, the project progress, quality rating, hidden dangers and other information and data are displayed in a centralized manner.

- ◆the access layer is the window for external interaction of the platform. Administrators and users at all levels can read, modify, update and maintain the system according to their rights.

3 Results

3.1 Project Quality Online Supervision and Management Mode

I. Application Practice.

Through the quality filling information system, the real-time and automatic upload of quality data information can be realized. The quality data of each project can be statistically analyzed automatically according to the annual identification, forming an intelligent quality tracking system, which can realize dynamic supervision of project progress and achievements and timely find out the hidden quality problems of a project. The supervision of the quality behavior of the subject unit of project quality responsibility can be realized, and help find out the reasons and develop relevant measures to ensure the quality control.

Through the quality filling information system, timely online tracking of project personnel input, target task completion, progress and achievement, focusing on the supervision of field construction progress and quality, field acceptance and rectifica-

tion, entrusted business progress and achievement quality, timely discovery or pre-judgment of quality problems and hidden troubles and supervise the solution. Every bi-monthly online evaluation of the quality control of the project team, the quality control of the undertaking unit, the chief business guidance and training activities of the project, whether there are quality problems and hidden troubles in the project, and point out the existing quality hidden troubles. Specific supervision of the following contents. See Table 1 for details.

II.Example.

Relying on the information technology, the "Geological Survey Project Quality Filling System" has been developed by China Geological Survey, and geological survey projects have begun to fill in the progress and quality of project implementation online. The online quality supervision mode has been implemented. Figure 2 is the examples of explanations.

The main problems: one is that the completion rate of the work progress reported by individual projects is inconsistent with the actual completion situation; two is that there are missing items in the filling of individual projects, such as the physical workload is not filled in, the quality activity is not filled in, the data upload is not timely and so on. Before the evaluation, the project management department (Science and Technology Department) of the project undertaking unit should review the data information filled in the project and fill in the review results in the system. In terms of system operation, there are problems such as imperfect system functions and insufficient data analysis and utilization, which need to be further upgraded. See Table 2 for details.

Table 1.Online Quality Evaluation Index.

Indicator	Content
Project progress	the completion of the target task;the completion of the main physical workload, and the implementation of the program requirements are consistent
Project quality control	(1) the quality activities in the implementation of the project;(2) to ensure the quality of the project to carry out the relevant training and other conditions;(3) the project undertaking unit of the project quality control.
The performance of the chief duty	the implementation of the project organization, the performance of the chief duty, whether in the project technology, quality, progress and achievements play a due role.
The performance of the project leader	the implementation of the project organization, the performance of the project leader, whether in the project technology, quality, progress and achievements play a due role.
Project personnel input	whether the composition of the project personnel meets the requirements of the implementation plan, whether to meet the project operation conditions.

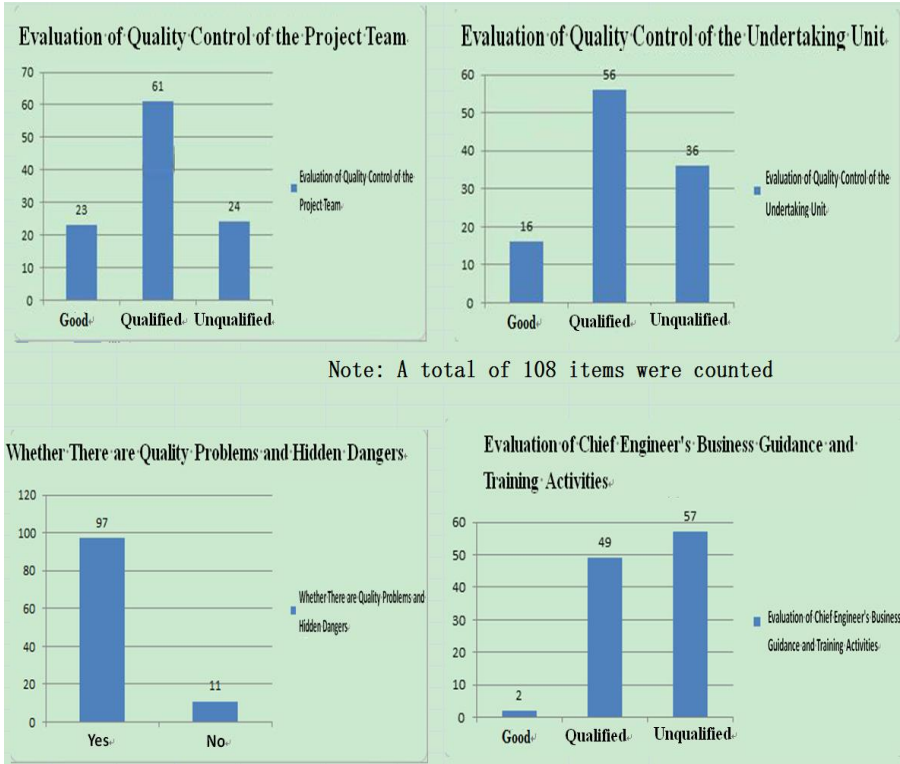


Fig. 2. Project quality online evaluation chart

Table 2. Online Quality Supervision List of Geological Survey Projects (January-October)

No.	Project Name	Project Nature	Project Attributes	Name of Undertaking Unit	Project Leader	Funds	Implementation Progress	Completion Ratio	Project Quality	Quality Evaluation			
										Evaluation of quality control of the project team	Evaluation of quality control of the undertaking unit	Evaluation of Chief Engineer's Business Guidance and Training Activities	Whether there are quality problems and hidden dangers
1	XX	Sequel project	Category A Project	XX	XX	XX	Normal	61%	The work progress is normal, and the completed field work is excellent. The quality control of the project should be strengthened.	Qualified	unqualified	Qualified	yes

No.	Project Name	Project Nature	Project Attributes	Name of Undertaking Unit	Project Leader	Funds	Implementation Progress	Completion Ratio	Project Quality	Quality Evaluation			
										Evaluation of quality control of the project team	Evaluation of quality control of the undertaking unit	Evaluation of Chief Engineer's Business Guidance and Training Activities	Whether there are quality problems and hidden dangers
2	XX	Sequel project	Category A Project	XX	XX	XX	Slowly	55%	The work progress is slow, and the mid-term inspection has been carried out for the entrusted business. The quality control of key links of the project should be strengthened, and the chief engineer should strengthen the business guidance.	Qualified	Qualified	unqualified	yes
3	XX	Sequel project	Category B Project	XX	XX	XX	Normal	85%	The work progress is good, and 6 entrusted business projects have been accepted, with good quality control of the results.	Good	Qualified	Qualified	no
4	XX	Sequel project	Category A Project	XX	XX	XX	Normal	70%	The work progress is normal, 8 items of physical work have been completed, the quality control is good, and the other 3 items are being implemented.	Good	Qualified	Qualified	no
5	XX	Sequel project	Category A Project	XX	XX	XX	Lag	35%	The work progress lags behind, so the field construction progress of the project should be accelerated, the quality of key links should be controlled, and the business guidance and work coordination should be strengthened.	unqualified	unqualified	unqualified	yes

No.	Project Name	Project Nature	Project Attributes	Name of Undertaking Unit	Project Leader	Funds	Implementation Progress	Completion Ratio	Project Quality	Quality Evaluation			
										Evaluation of quality control of the project team	Evaluation of quality control of the undertaking unit	Evaluation of Chief Engineer's Business Guidance and Training Activities	Whether there are quality problems and hidden dangers
6	XX	New project	Category A Project	XX	XX	XX	Lag	30%	The drilling construction progress lags behind, so the construction progress should be accelerated, the quality of drilling engineering should be controlled, and the business guidance should be strengthened.	Qualified	Qualified	unqualified	yes
7	XX	New project	Category A Project	XX	XX	XX	Normal	80%	The work progress is good and the quality control is good.	Good	Qualified	Qualified	no
8	XX	New project	Category A Project	XX	XX	XX	fast	90%	The vast majority of the physical workload has been completed, and the quality control measures are effective.	Excellent	Good	Good	no
9	XX	Sequel project	Category A Project	XX	XX	XX	Normal	75%	Work progress is normal, and quality control measures are in place.	Qualified	Qualified	Qualified	no
10	XX	Sequel project	Category B Project	XX	XX	XX	Normal	60%	The work progress is normal, and there are quality control measures. It is suggested to strengthen the quality control of key links of the project.	Qualified	Qualified	Qualified	yes

Note: A total of 108 items were counted, only 10 items were listed.

3.2 "Double Random and One Open" Quality Supervision and management Mode

I. Application Practice.

Through the "double random and open" management system, in the way of "intelligent" lottery, the inspection items and quality inspection personnel are randomly selected from the library, and the reasonable proportion and frequency of spot check are determined [10]. The whole process of spot check is recorded, and the responsibility can be traced back. Fourth, the inspection results are published, and they are subject to supervision, and they are connected with the integrity system and linked with credit.

◆ According to the key points of the management of financial funds, the supervised projects (except for the projects that are inspected regularly and not randomly selected) are divided into A, B and C categories. The C category projects with a large scale of funds are taken as the key supervision objects, with a large probability of sampling and increased inspection frequency; the B category projects with a general scale of funds are set with a medium probability of sampling and maintain a certain frequency of inspection; the A category projects with a small scale of funds are set with a low probability of sampling and appropriately reduce the frequency of inspection.

◆ The operation logic of grade weighting and end of the period is adopted. The supervision probability of A, B and C increases in accordance with a certain proportion, and the interval random number extraction method is used for extraction. According to the scoring method, the system implements a downgrade management mechanism for A, B and C projects. When the problems in the quality supervision process of A and B projects reach a certain standard, the system will automatically adjust them to B and C projects, and increase the supervision efforts. The bottom-up mechanism. The system automatically calculates the total number of remaining inspection times that have not reached the minimum. According to the average monthly inspection times, the remaining unfinished indicators are randomly selected until all of them reach the standard.

II.Existing Problems.

"Double random, one public" supervision mode has not yet formed the corresponding system, such as the problems that cannot be found in the double random work inspection, whether the personnel in charge of the double random work inspection can be accountable, etc. There are no specific implementation specifications, and relevant implementation measures should be introduced as soon as possible. By further improving the design of the top-level system of "double random and one public", the double random sampling mechanism should be standardized.

4 Conclusion

The information construction of quality supervision and management is the booster to promote the modernization of quality supervision work. The establishment of a digital

supervision platform with information technology as a means can accurately, comprehensively and timely grasp the quality supervision information of geological survey projects, which is helpful to strengthen the supervision of the quality behavior of the responsible subjects and quality supervision institutions of geological survey projects, and significantly improve the supervision efficiency and level of geological survey project quality. In the future, we should strengthen the deep integration of quality management and information technology, strengthen the integration and integration of all kinds of information resources, comprehensively realize the online monitoring of quality process, and build a quality management information system with scientific management, optimized process, standardized operation and efficient supervision.

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