The Research on the Necessity and Effectiveness of Operating the ISO Quality Management System Standard in Geological Survey Project Undertaking Units

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Abstract. This paper analyzes the establishment and implementation of the ISO9001quality management system standard in geological survey project undertaking units, conducting an investigation and analysis on the necessity and effectiveness of theISO9001 standard. The questionnaire survey was conducted in 45 units from seven aspects, which are the significance of the ISO9001 quality management system in the unit's management, the significance of internal audit in the ISO9001 quality management system, the significance of management review in the ISO9001 quality management system, the significance of two-party or three-party audits in the ISO9001 quality management system, the necessity of carrying out two-party certification and three-party certification, the necessity of the ISO9001 implementing quality management system，the implementation of the ISO9001 quality management system is unnecessary in the unit. Relevant conclusions and suggestions are subsequently proposed. The paper points out that the construction of the ISO9001 quality management system is helpful to improve the quality consciousness and quality assurance ability of geological survey project undertaking units as a whole. Geological survey project undertaking units should combine their own characteristics, and gradually form a continuous improvement mechanism.

Keywords: the ISO9001 quality management system standard, geological survey project undertaking units, the necessity and effectiveness

1. Introduction

The ISO9001 quality management system standard is recognized as the world's advanced quality management, it has the advantage of quality-related activities for system control[1], reflected in the customer as the focus of attention, prevention, continuous improvement of management concept, has been adopted by more and more organizations, application fields from industry and agriculture, service industry rapidly expanded to the government administration and public service sector. So far China has more than 3600 government departments have carried out beneficial practice and exploration, and achieved good results[2]. Practice has proved that the government departments to introduce quality management system, can effectively promote the scientific management, institutionalization, standardization, but also in line with international practice and the development trend of global government

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management innovation.

On September 23, 2015, the International Organization for Standardization (ISO) issued a new version of the quality management system standard (ISO9001:2015)[3]. In particular, it emphasizes the importance of using PDCA and risk-based thinking in the application of quality management system. Armand Vallin Feigenbaum proposed the core idea of total quality control is to take quality as the core, to all staff participation as the basis, through continuous improvement , improve the overall performance of the organization[4]. PDCA cycle is the scientific procedure that should be followed by total quality management. PDCA cycle was first proposed by Walter A. Shewhart (1939) in the United States quality management expert, was adopted, publicized and popularized by Dr. Deming (Dr. Deming), so it is also called Deming circle. The meaning of PDCA cycle is to divide the quality management into four stages, namely Plan (plan), Do (execute), Check (check) and Act (handle)[5]. In the quality management activities, the requirements of the work in accordance with the plan, plan implementation, check the implementation effect, and then the success of the standard, not successful to be left to the next cycle to solve. This working method is the basic method of quality management.

In January 2017, China began to implement the new version of GB/T19001-2016 quality management system standard[6]. On January 26, 2018, the State Council issued Guofa (2018) No.3 titled "Opinions on Strengthening the Construction of Quality Certification System to Promote Total Quality Management," which presented a series of requirements aimed at fortifying the establishment of a quality certification system, enhancing total quality management, and propelling economic development into an era focused on quality. The new period put forward new and higher requirements for the construction of quality management system[7].

2. The Construction and Operation of the ISO 9001 Quality Management System Standard of the Geological Survey Project Undertaking Units

Geological survey is characterized by research, professionalism, diligence, confidentiality, lengthy cycles, and high risks. Its outputs encompass mineral reserves as well as geological data and information achievements presented in written form and graphical representations. The quality is reflected in the quality of original geological data and achievements, such as regional surveys, marine surveys, oil and gas mineral surveys, geophysical and geochemical exploration, aviation geological surveys, geological drilling, geological experiments and other field original records and original maps, as well as the quality of final geological achievements, that is, the quality of various geological reports. it also relies on the excellence of final geological reports which serve as a crucial indicator of technical expertise and management proficiency within geological survey units.

Since 2000, China Geological Survey (CGS) has implemented the ISO9001 quality management system standard in geological survey project undertaking units, effectively integrating its principles and methods into the entire project management process[8]. This includes documentation and control of project approval, design, field construction, field

acceptance, indoor finishing, achievement review and acceptance, as well as the links and processes related to the project such as outsourcing and procurement, have been documented and controlled, and formed relevant quality records.

The construction of the ISO9001 quality management system in the geological survey project undertaking units has gradually progressed, as evidenced by the summary and analysis of 86 units, including 27 subordinate units,31 provincial geological survey institutes and 28 provincial monitoring institutes (stations). Notably, the number of units that have obtained social tripartite certification or two-party certification from the CGS has increased significantly from 64 in 2005 to 207 in 2015, representing a growth rate exceeding threefold.

"By implementing a quality management system through certification, we strengthen process control and continuously improve our quality consciousness. We pay close attention to customer needs in procurement, outsourcing processes, testing/inspection, equipment monitoring and measurement, as well as other management links and quality activities. Our geological survey project undertaking units have strengthened pre-review procedures and implemented inspections before review and acceptance to achieve effective control of important quality links. This has played an important role in promoting standard management of the project undertaking units and projects while avoiding management risks. Quality can be traced for audit purposes. Through regular internal quality management system audit, management review, gradually formed a continuous improvement mechanism[9]. Quality management activities and quality management behavior constantly standardized and more in line with the standard requirements, the overall operation is good, the quality control procedures have been effective operation.

"The transformation of the ISO 9001 quality management system standard into industry-specific quality management standard often leads to varying interpretations of standard terms and inconsistent levels of implementation, resulting in uneven construction of the ISO 9001quality management system standard. At present, the operational adaptation of the ISO 9001 quality management system standard in the geological survey project undertaking units still has the problem of not adapting to the actual situation. Because of the particularity of the geological survey industry, it is easy to form the phenomenon of "two pieces of skin". Therefore, it is imperative to enhance the evaluation of the ISO 9001 quality management system standard operations."

3. The Analysis of the Necessity and Effectiveness in Operating a Quality Management System for Project Undertaking Units.

The necessity and effectiveness of the ISO 9001 quality management system operation in geological survey project undertaking units were further analyzed and studied through a questionnaire survey conducted among 344 individuals from 45 units.

According to the statistics of the questionnaire, 21.81% of the respondents believed that it was necessary to carry out the two-party certification of China Geological Survey, and 28.49% of the respondents believed that it was necessary to carry out the three-party certification.

1. The analysis of feedback received from subordinate units.

The positive role of the ISO 9001 quality management system standard is perceived as follows: 41.57% of respondents believe that it can effectively mitigate unclear responsibilities and enhance mutual understanding among stakeholders. 38.38% acknowledge its potential to significantly elevate staff's quality awareness through implementation. Additionally, 37.50% recognize its ability to enhance project outcomes' quality. Furthermore, 25.59% consider the adoption of a quality management system essential for bidding purposes. Lastly, 50.88% affirm that such a system ensures effective control over all unit processes and links, enables traceability of quality records, standardizes unit-wide quality management practices, mitigates managerial risks, and enhances overall organizational performance.

Negative opinions on the role of the ISO quality management system standard: 28.78% of respondents believe that theISO9001 quality management system is not suitable for the geological survey industry. 19.19% of respondents find it challenging to effectively implement the ISO 9001 quality management system standard, often encountering superficial implementation. 16.86% of respondents argue that standard specifications and systematic approaches can substitute for the ISO 9001 quality management system standard. 11.34% of respondents suggest adopting a more advanced management system instead. 17.16% of participants believe that Three-level quality inspection system formed over the years in the geological survey industry can fully achieve desired outcomes without requiring mandatory certification for the quality management system. 27.62% of individuals propose that while CGS should encourage, it should not enforce compliance with the quality management system standard strictly.7.27% express concerns about unit leaders' lack of attention and insufficient promotion by business departments towards implementing the quality management system actively.2.33% perceive no tangible impact from implementing the quality management system.

2. The analysis of feedback from industry units

22.1% of people think that the implementation of the ISO 9001quality management system is the need for bidding. 30.24% of people think that the quality management system can ensure that the unit processes, each link is effectively controlled, quality records can be traced, can standardize the quality management work of the unit, avoid management risks, improve the management level.

According to the feedback from the questionnaire statistics, 27.91% of respondents believe that the implementation of the ISO 9001quality management system standard can effectively reduce the responsibility is not clear, each other to pass the buck phenomenon. From the feedback of the questionnaire statistics, 28.78% of participants hold the opinion that implementing the ISO 9001quality management system standard can significantly enhance staff's awareness towards quality within their respective units. Based on the responses received in the questionnaire, 29.36% of individuals believe that implementing the ISO 9001quality management system standard within their units can improve the quality of the unit project results. Regarding whether bidding is necessary for implementing the ISO 9001quality management system standard, 22.1% of respondents expressed agreement with this requirement. According to survey results, 30.24 % of participants believe that the ISO 9001quality management system standard ensures effective control over unit processes and

each link thereof; it also enables traceability through proper documentation while standardizing and mitigating potential risks in unit-level operations thereby enhancing overall managerial proficiency.

Negative opinions on the role of the ISO 9001quality management system standard: 6.11% of the respondents believed that the quality management system was not suitable for the geological survey industry. 2.62% of the respondents believed that the ISO 9001 quality management system standard was difficult to implement effectively, often being two-layered. 4.36% of the respondents believed that standard, specifications and regulations could replace the ISO 9001 quality management system standard. 1.46% of the respondents believed that a more advanced management system could be chosen. 2.04% of the respondents believed that quality management could be fully achieved through three-level quality management, and the ISO 9001 quality management system standard certification was not necessary to be compulsorily implemented. 5.53% of the respondents believed that the Geological Survey should encourage but not compulsorily implement the ISO9001quality management system standard. 3.78% of the respondents believed that the ISO 9001quality management system standard had no effect.

The statistical summary table 1 for the questionnaire survey is available for reference[10].

4. Conclusion

The establishment of the ISO9001 quality management system is an ongoing process of continuous improvement. It serves to enhance the overall quality awareness and guarantee capability of the geological survey project undertaking units.

The implementation of the ISO 9001 quality management system is focused on ensuring operational effectiveness. Attention should be given to constructing a practical quality management system that identifies any existing gaps and addresses new situations and tasks. Continuous improvement efforts should enhance the suitability of the quality management system, ensuring its synchronization with construction and development. It is important to timely summarize experiences and lessons learned from operating the ISO9001 quality management system, constantly exploring, summarizing, and innovating for continuous improvement. The aim is to guide and regulate quality activities and behaviors in line with current trends, effectively guaranteeing improved quality in each unit while meeting customer requirements to ensure the continuous and effective operation of the quality management system. The ISO9001 quality management system is a globally recognized and advanced method for ensuring quality. CGS should continue to implement and promote the ISO 9001 quality management system standard by taking into account various factors.

The geological survey project undertaking units should integrate its own characteristics and establish a continuous improvement mechanism through regular internal audits of the ISO quality management system and management reviews. Furthermore, it is essential to enhance the organic integration between the ISO 9001 quality management system and project management, avoiding "two pieces of skin". Strengthening information supervision and management of the ISO 9001 quality management system operation is crucial. By implementing network control and document management for the ISO 9001 quality

management system, real-time online queries, statistics, and analysis of internal audits, management reviews, as well as rectification of quality problems can be conducted to timely obtain operational insights into the ISO 9001 quality management system. Utilizing information technology will facilitate comprehensive improvements in managerial performance.

Table 1: The Statistical Analysis of the Questionnaire Survey on the ISO9001 Quality Management System

	the content of the investigation.	subordinate units	industry units(two-party certification from the CGS)
1	The significance of the ISO9001 quality management system in the unit's management		
	The system enables the standardization and streamlining of unit management, mitigating potential management risks.	49.13%	28.49%
	It can mitigate the issue of ambiguous responsibilities and reciprocal finger-pointing.	41.57%	27.91%
	Ensure that all processes and links of the unit are effectively controlled, quality records can be traced, and management level is improved.	50.88%	30.24%
	The quality of geological survey projects has not witnessed significant improvement.	11.34%	2.33%
	the ISO9001 Quality management can be attained through a three-tiered approach, without the mandatory adoption of a quality management system certification.	17.16%	2.04%
	The functionality is not operational.	2.33%	
2	The significance of internal audit in the ISO9001 quality management system.		
	Can identify non-conformances and potential issues in the operation of the ISO9001 quality management system, as well as assess the operational status of the unit's quality management system.	50.88%	27.62%
	The internal auditors possess a limited comprehension of the ISO9001 quality management system, and their inspections are conducted in a perfunctory manner.	9.89%	4.07%
	The functionality is not operational.	3.78%	
3	The significance of management review in the ISO9001 quality management system.		
	The suitability of the quality policy and quality objectives of the unit was evaluated.	43.03%	28.49%
	The assessment of resource availability and demand, adjustment, and fulfillment of customer needs.	36.63%	26.17%
	Assess the adequacy, suitability and effectiveness of the quality management system and develop corresponding measures。	43.90%	29.95%
	The problems encountered in project implementation and management are assessed, and corresponding measures are proposed to facilitate the continuous enhancement of the ISO9001 quality management system.	49.13%	29.36%

	the content of the investigation.	subordinate units	industry units(two-party certification from the CGS)
	The management review is merely a procedural requirement, and the leadership of the unit refrains from providing a substantial assessment.	5.53%	0.88%
	The functionality is not operational.	2.62%	
4	The significance of two-party or three-party audits in the ISO9001 quality management system.		
	The audit of the quality management system can verify whether the unit's quality management system complies with the ISO9001 standard.	46.81%	28.20%
	Can supervise and guide the quality management work of the unit.	44.77%	29.95%
	The unit's ability can be demonstrated.	31.40%	22.68%
	Can fulfill the bidding requirements.	37.79%	37.79%
	The two or three party audit has no effect, mostly become a formality, the ISO9001 quality management system has not gone deep into the management of the unit, often forming two pieces of skin。	7.85%	26.17%
5	The necessity of carrying out two-party certification and three-party certification		
	The implementation of CGS two-party certification is essential.	21.81%	14.25%
	The implementation of tripartite certification is imperative.	28.49%	8.43%
	The implementation of CGS dual-party certification and the involvement of a third-party certification company are essential.	21.52%	17.45%
	①The implementation of third-party certification is unnecessary as it does not provide a guarantee or enhance the quality of projects.②The necessity of establishing a credit rating system.	2.33%	0.29%
6	The necessity of the ISO9001 implementing quality management system		
	The ISO9001 quality management system implemented is a relatively mature management method at present.	34.02%	24.42%
	The implementation of the ISO9001 quality management system can standardize the unit's quality management practices, mitigate management risks, and enhance the level of management.	50.88%	30.24%
	The implementation of the ISO9001 quality management system can significantly enhance the staff's awareness of quality within the unit.	38.38%	28.78%
	The implementation of the ISO9001 quality management system can improve the quality of unit project results.	37.50%	29.36%
	The implementation of the ISO9001 quality management system is essential for the bidding process.	25.59%	22.10%
	The expression of a negative viewpoint.	2.62%	0.88%
7	The implementation of the ISO9001 quality management system is unnecessary in the unit.		

	the content of the investigation.	subordinate units	industry units(two-party certification from the CGS)
	The application of the ISO9001 quality management system is not appropriate for the geological survey industry.	28.78%	6.11%
	The ISO9001 quality management systems are difficult to implement effectively, often two-tiered	19.19%	2.62%
	The implementation of standards, specifications, rules, and methods can serve as alternatives to quality management systems.	16.86%	4.36%
	More advanced management system can be chosen	11.34%	1.46%
	CGS should encourage but not enforce the quality management system.	27.62%	5.53%
	The leaders of the unit fail to recognize its importance, and the departments lack proactive implementation of the ISO9001 quality management system.	7.27%	
	①The management system for scientific research units cannot be the same as that for production units；②The implementation of third-party certification is unnecessary due to professional constraints.	2.91%	3.78%

1st Authors' Instruction: Long-term engaged in geological and mineral economic research. Responsible for the construction and operation of the ISO 9001 quality management system of the unit for many years, and provide assistance to the operations of CGS. Theoretical and practical expertise in the ISO 9001 quality management system has been extensively accumulated.

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