Construction Exploration of Chongqing Environmental Supervision Information System under the Background of Environmental Protection Vertical Reform

Wang Luxiao\textsuperscript{1a}, Huang Xiaoyan\textsuperscript{2b}, Jiang Rong\textsuperscript{3c}, Hu Xiaoming\textsuperscript{4d}

\textsuperscript{1}Information Center of Chongqing Environmental Protection, Chongqing, China
\textsuperscript{2}Information Center of Chongqing Environmental Protection Chongqing, China
\textsuperscript{3}State Grid Chongqing Electric Power Company Chongqing, China
\textsuperscript{4}Chongqing High-tech Engineering Survey and Design Institute Co., Ltd. ,China

\textsuperscript{a}48182377@qq.com \textsuperscript{b}1813459524@qq.com \textsuperscript{c}Jr628@163.com \textsuperscript{d}516000127@qq.com

Abstract: According to the environmental protection vertical management reform requirement, the environmental supervision information system was designed based on the existing informational situation and the responsibility of Chongqing environmental supervision office. The system built the whole management process of collecting, screening, assigning, examining, checking, feedback, verification and canceling problems. The integrated environmental supervision information system established the vertical and horizontal data exchange channel among the ministry of environmental protection, Chongqing environmental protection bureaus and the municipal departments. It not only provided an information working platform for the supervision of environment supervision office, but also provided a good example for environmental supervision information construction.

1. INTRODUCTION

In September 2016, the General Office of the Central Committee and the General Office of the State Council issued and distributed the Guiding Opinions on the Pilot Reform of the Vertical Management Regulation for Monitoring and Supervision of Law Enforcement by Environmental Protection Agencies at and below the Provincial level. The file had taken the lead in initiating and implementing the reform of the vertical management regulation of environmental protection institutions throughout the country. Chongqing became one of the first two pilot provinces and cities in China, and had set up an environmental supervision agency: the Chongqing Environmental Supervision Office (referred to as the "Municipal Environmental Supervision Office"). The Chongqing Environmental Supervision Office undertook to organize and coordinate the work of environmental protection supervision in Chongqing and realized the separation of environmental supervision and environmental law enforcement. In order to ensure the effective development of environmental protection inspection work, this article had designed the municipal integrated environmental supervision information system by means of information technology. Using the concept of "Internet + Environmental Protection Supervision", the environmental supervision information system realized the collection, screening, distribution, tracking, supervision, feedback and information support for the whole process of environmental supervision matters.
2. Research Status and Overview

2.1 Research Status
With the development of information technology, the environmental supervision information construction and application research has also made great progress\textsuperscript{[1-6]}. Wu put forward the perfect strategy of environmental supervision and law enforcement information system based on the system construction function module in the information age\textsuperscript{[1]}. Chen set out the main points and the construction purposes of various information systems from the service targets of environmental supervision information systems\textsuperscript{[2]}. Based on the cloud platform, Zhang Yanjun developed the environmental supervision mobile law enforcement system based on "one platform, one center, two major systems"\textsuperscript{[3]}. The environmental supervision mobile law enforcement system has been developed and achieved good application results. Since 2011, the Ministry of Environmental Protection has launched the Pilot Project for the Construction of Environmental Supervision Mobile Law Enforcement System, which has been piloted throughout the country, further promoting the construction of environmental supervision information.

In 2015, the central government clearly proposed the implementation of the vertical management regulation for monitoring, supervision and enforcement of environmental protection agencies below the provincial level. A large number of scholars began to discuss the reform of the vertical management system\textsuperscript{[7-12]}. Xing Shuwei discussed the objectives of the vertical management from three aspects: the difficulty of reform, the coordination management smoothness of monitoring business work and the connection of personnel financial management\textsuperscript{[7]}. Several reform models at the provincial and municipal levels were discussed. The advantages and problems of various models also were analyzed. Weng Zhixiong discussed the theoretical basis, domestic and foreign practical experience of the environmental protection supervision regulations, and put forward some suggestions to speed up the implementation of the environmental protection supervision regulations\textsuperscript{[8]}. From the aspects of information source analysis method, information collection method, information retrieval method and information processing method, etc., Song Yang studied the information acquisition mechanism of macro environmental supervision\textsuperscript{[9]}. So far, many scholars have focused on the theoretical research of the environmental protection supervision regulations. Information technology has also been applied to traditional environmental supervision and law enforcement work. They only took "supervising enterprise" as the main application purpose without aiming at the application purpose of supervision. Little research has been done on how to utilize information technology to support environmental supervision under the vertical management. This article will develop a unified environmental supervision and dispatch management system based on the municipal e-government network. In accordance with the environmental protection agencies and inspectors requirements of the reform of the vertical management regulation, the environmental supervision information system ensures the transmission of the environmental supervision management information in real time among the municipal departments, district and county party committees, governments, and other levels of environmental supervision agencies.

2.2 Operational Requirements
The purpose of the Chongqing environmental supervision information system is to coordinate the municipal environmental protection supervision work utilizing information technology to achieve the refined management of the feedback issues of the central environmental protection inspectors and the entire process of the Chongqing environmental protection inspector work. Through many years of information construction, the urban integrated network and security support platform have been initially established. The environmental protection cloud network system connects to the ministry of environmental protection, the municipal departments, the environmental protection bureau of the lower district(county), the outreach sewage enterprises, and the public. At the same time, the environmental data resource centre has been initially established to centralize and harmonize environmental data management. The environmental data resource centre gradually provides structured, document and
spatial data services for operational systems. In order to improve the efficiency of environmental supervision, this article aims to build a Chongqing environmental supervision information system that covers the collection, monitoring, inspection, and assessment of problems based on information technology, the environmental protection cloud network system and the environmental data resource center. The system will promote information exchange and improve the lists of environmental protection responsibilities, task and problem of relevant departments at the district, county and municipal levels, update them dynamically, standardize the work flow of monitoring.

3. SYSTEM DESIGN

3.1 General Framework of The System
The system is designed and constructed on the basis of the uniform application software standards, organizational, operation and maintenance support. It follows the principles of completeness, advancement, scalability and portability. The overall framework of the system is designed as figure 1.

![Figure 1 Structure of Chongqing Environmental Supervision Information System](image)

The system has designed five parts: foundation layer, data layer, service layer, application layer and user layer. The basic layer is based on the integrated network and security support platform of the environmental protection system. It adopts intensive construction and shares basic software and hardware facilities. The data layer relies on the Chongqing ecological environmental protection information data platform to provide data support for environmental supervision through data statistics, collation and analysis. The service layer integrates document data, spatial data, and structured data service released by the environmental data resource center to achieve the exchange and sharing of environmental data resources in the city. The application layer is a collaborative development platform with mature software life cycle. It quickly provides four major business application components such as major problem management, environmental supervision work management, environmental work assessment management and environmental protection data query. It supports flexible dynamic iterative upgrade extension during software development period. The interface layer refers to the user interaction interface. Based on the B/S architecture, different landing pages, home page styles, platform portals, and office desktops are flexibly customized for different units and individuals.
3.2 Business Process Design
Around the main responsibilities of the municipal environmental supervision office, the article has designed the business flow of daily environmental supervision. (see Figure 2 for details).

![Figure 2 Daily Environmental Supervision Business Flow Chart](image)

This system is issue-oriented. It designs two main modules for problem discovery and problem handling to implement the process management from the collection, screening, assignment, tracking, supervision, feedback and write-off of problems to the completion of the problem. The system supports the daily supervision work of the municipal environmental supervision office. On the one hand, the discovery of major environmental problems through manual registration and intelligent early warning, screening and classifying the problems are realized. On the other hand, the list of issues will be reviewed step by step and handed over to the rectification tracking. If the rectification problems are not in place or the overall improvement lags behind, the supervision will be carried out until the rectification problems be written off and concluded.

4. SYSTEM DEVELOPMENT AND FUNCTIONAL IMPLEMENTATION
The system designs four subsystems: major issues management subsystems, environmental supervision management subsystems, evaluation dynamic score subsystems and environmental information inquiry subsystem. The functions and compositions of environmental supervision information system are shown in Figure 3.

![Figure 3 Function and Composition Chart of Environmental Supervision Information System](image)

4.1 Management of Critical Issues
By combining manual registration with intelligent early warning, we collect problems through the channels of higher authorities, municipal departments, bureaus offices, news media, online public opinion and complaints. The collected problems refer to regional, basins, industrial and public environmental issues with strong response and poor social influence. By sorting out and analyzing all
kinds of complaints and related environmental regulatory data, we will generate clues on major environmental issues and establish adjudication rules. A semi-automated screening of major environmental problems, such as serious delays in the progress of environmental protection actions, strong public reaction, deterioration of environmental quality, abnormal examination and approval, sudden environmental accidents and hidden risks of risk sources have been established. Problem list management has been established and problems have been classified. The issues included in the management list shall be examined step by step to achieve the closed-end management of the whole process of problem assignment, tracking, supervision, feedback and settlement.

4.2 Environmental Inspectorate Management
It mainly aims at the supervision issues of the central environmental protection inspectorate and the municipal supervision and establish a ledger management. The central supervision bureau focuses on the problems and clues received from the central environmental protection supervision group. Through strengthening the process of sorting out problems, the central supervision bureau will hand over, follow up the problems and urges the relevant district, county party committees and relevant municipal departments to refine the rectification plans one by one and earnestly implement the rectification requirements. We will ensure that environmental problems are effectively rectified and put into place. If the correction is not in place, the effect is not obvious or the problem is not completely resolved, an intelligent reminder rule is established in order to promptly supervise and supervise. The municipal supervision refers to the establishment of a unified environmental supervision and dispatch management platform for the city in conjunction with the daily supervision and centralized supervision of environmental protection in Chongqing. The work system of "Internet + Environmental Supervision", which is handled by a network and tracked throughout the entire process. Environmental inspectorate management ensures that the information of environmental supervision and management at all levels such as municipal departments, district and county party committees.

4.3 Scoring Assessment Management
Through the design of dynamic pre-rating modules for assessment, we will integrate and share the environmental protection goals such as the "five actions" of environmental protection, the prevention and control of atmospheric and water pollution sources. An assessment index system has been established. According to the assessment rules, the performance assessment of environmental protection in districts and counties, the work evaluation of district and county environmental protection bureaus and the dynamic pre-evaluation of the environmental protection work of municipal departments will be realized. The scoring assessment management module provides important support for the implementation of the "Party and government duties" and "one post and two duties". Specifically, the scoring assessment management module includes functions such as dynamic evaluation scoring, zone ranking and itemized counting.

4.4 Environmental Information Enquiry Management
The system establishes a document directory system, based on the development and design of the TRS (Text Retrieval System) software platform. The document directory system includes ecological and environmental protection laws and regulations, important decision-making and deployment documents, leadership important speeches, target assessment tasks, environmental protection responsibilities and other document database. It integrates the files of pollution sources and provides the basic data of pollution sources. To facilitate timely inspection and inspection, the pollution sources’ document include relevant data, such as project approval and supervision, sewage discharge permits, letters and visits and complaints from 12369, environmental quality and automatic supervision of pollution sources, hidden dangers investigation and rectification and handling of environmental emergencies.
5. CONCLUSIONS
1) Based on the analysis of business requirements, the framework of five layers of system: foundation layer, data layer, service layer, application layer and user layer was designed. It has established a closed management process for the collection, screening, distribution, tracking, inspection, feedback and write-off of questions. A working platform has been developed for environmental supervision information. It has realized system functions such as major problem management, environmental protection supervision management, assessment statistics management and environmental protection data management.

2) By analyzing the current situation of the environmental supervision information construction and the responsibilities of the Municipal Environmental Supervision Office, this article has designed and developed an environmental supervision information system to meet the daily work needs of environmental supervision. The system promoted the informatization, standardization, science, and precision of environmental supervision. It has effectively improved the efficiency and work level of environmental supervision and annual assessment.

3) This system provides a platform for environmental supervision informatization work and makes up for the gap in informatization construction for the purpose of applying environmental supervision after the reform, which provides a good reference and demonstration for the construction of environmental supervision informatization.

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