The Research of China's Urban Smart Environmental Protection Management Mode

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Abstract. The application of the Internet of Things (IOT) and next-generation information technology makes the digital environmental protection become smart environmental construction, and therefore makes our government's environmental management mode being changed. By studying some smart city application cases and literatures, this paper not only proposed the government management's operation mode and organization structure for the smart environmental protection, but also discussed an effective method to improve the working efficiency.

Keywords: Smart environmental protection, management mode, organization structure.

1   Introduction

The global urbanization develops fast in recent years, particularly in developing countries. Rapid growth and the continuous expansion of the city's population has brought a lot of problems, such as traffic congestion, environmental degradation, lack of basic resources, job stress, energy supply tension, increased crime, etc.. To solve these problems, it requires innovative urban operations and management mode, achieving scientific and rational planning, intelligent building and efficient management. In this context, the smart city construction become to a hot spot in the global field. The definition of smart city at present academia is uncertain. Professor Li Deren, Wuhan University, gave its definition: Digital City + Internet of Things (IOT) = Smart City. Therefore, I believe the city is to use the IOT, cloud computing, mobile networks, GIS and other next-generation computer technology to run the city scientifically and systemically, to achieve sustainable development of urban economy, society and the environment, and to improve the quality of urbanization, at the development pattern of smart construction, intelligence service, intelligence decision making and processing.

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In the application field of smart city, the application of urban ecological environmental protection has caught more and more attention. China's urban pollution has been more serious, the city's development has brought a lot of waste water, gas and garbage which are difficult to deal with. Our government has realized the needs to intensify environmental protection, and adopt a series of policies and measures to control pollution and improve urban environmental quality. National Bureau of Statistics data show that environmental pollution control investments of gross domestic product (GDP) ratio, from 0.51 percent in the early 1980s, had increased to 1.59 percent in 2012[3]. As the emphasis on environmental protection continues to improve, in 2010 the Ministry of Environmental Protection, the Ministry of Industry and Information Technology jointly announced, in five years, the country will basically built up "smart green" system, establish environment information management system which fits the environmental protection work in a new era, form a reasonably and smoothly work mechanism, and make the environmental information network system covering the whole country. Smart environmental protection is to implement daily monitoring for the air pollution, water pollution, and solid waste by sensors and monitors. And through the cloud networking to integrate environmental protection IOT, conduct data collection, information processing, information sharing, and decision support, to achieve environmental management and decision-making dynamically, and ensure that people live in a healthy environment. The construction of smart environmental protection system helps the environmental protection departments monitor environment and pollution efficiently, helps to improve the efficiency of environmental management and scientific decision-making levels, helps to security the ecological environment, create a better living environment for people, improve people's lives quality, and build a harmonious social environment.

2   Development Situation at Home and Abroad

2.1   Development Situation Abroad

At the end of 2008, IBM proposed the "Smart Planet" concept for its own industrial transformation and commercial purposes of software and services market. With the rapid development of information technology in recent years, countries in the world generally accepted the "Smart Earth" ideas, and digital and intelligent is recognized to be the future trend of social development. United States took the lead out of the National Information Infrastructure (NII) and the Global Information Infrastructure (GII) plan, and in 2009 built America's first "smart city" in Iowa City, Dubuque. Connected all the resources of the city together for analysis and integration of all kinds of data by IBM's new technology, and respond intelligently, to serve the citizen' needs. Then the EU began promoting the "Information Society" program, set the information and communication technology as a European strategic development priorities, developed the "Europe 2020 strategy", and proposed three key tasks: smart growth, sustainable growth and inclusive growth. Japan developed the "i-Japan 2015 strategy" in July, 2009, aimed at social integration of digital information technology and promoting e-government reforms. In June 2006, Singapore launched the "smart country 2015"

plan, intended to achieve national digitization, and make IT industry become a new economic growth point of Singapore.

2.2   Development Situation at Home

Our government attaches great importance to the development of smart city and IOT. In China, the smart city construction is government-led, research institutes involved in the construction business. When Premier Wen Jiabao inspected the CAS Wuxi R & D of wireless sensor network engineering center at August 7, 2009, he clearly required to establish Sensing Information Center as soon as possible. Science and Technology Minister Wan Gang's speech at the Shanghai World Expo, "Let the future development of science and technology to lead the city," pointed out to strengthen the application and popularization of information, intelligence and other technologies, so that "run the city with perception and adaptive capacity.

Under the encouragement of national policy, some provinces and cities have already put smart city on key research topic. Shanghai, Chongqing, Nanjing and other cities is based on the construction of information infrastructure to drive the construction of smart city. Wuxi, Hangzhou and other cities set the construction of IOT as the sally pot for the construction of smart city. Beijing, Wuhan, Suzhou and other cities are building demonstration projects to promote smart city construction.

Smart environmental protection is an important application area of "smart city", but the theory and practice about smart environmental protection at home and abroad are few. At present, China only has several limited smart environmental protection pilot, such as Weihai, Xiangtan, North Wharf District, Ningbo and other places, this is because our information infrastructure is imperfect, R & D level is weak, the sensor is difficult to promote the high cost of production. "The Second China Environment Information Technology Forum" was held in Nanning, Guangxi in June 2012, with "serve environmental protection, smart ahead " as the theme, further explore the new ideas of Chinese environmental protection industry around the e-wise and technology application, and promote the transformation of "digital environmental protection" to the "smart environmental protection". Xu Min , etc. discussed the concept of wisdom environmental protection in the " from digital environmental protection to smart", explained the IOT technology of environmental protection is the key to implement environmental protection transformation from digital to smart, and stated it should strengthen the construction of perception layer and smart layer; Professor Liu Rui, in Beijing Normal University, discussed the main task of China's environmental protection system construction content and suggestions for environmental construction in "the discussion of our smart environmental protection system".

2.3   The Overall Framework of Smart Environmental Protection

The construction of "smart green" mainly consists of the following application systems: on-line monitoring system of pollution sources, dust and noise, environmental information release systems, environmental data center, environmental emergency management systems, environmental comprehensive business processing systems,

environmental geographic information systems[2]. The overall framework for the environmental smart is of four layers, they are the data collection layer, data communication layer, data management layer and data application layer from the bottom up. Data collection layer is to achieve real-time supervision of environmental factors such as environmental quality, pollution, ecology, and other radiation mainly through sensors monitoring equipment. Data communication layer is to use real-time monitoring data by the Internet technology, wired and wireless communications technology to realize interaction of environmental information and sharing. Data management layer means to take advantage of cloud computing, storage technology, to integrate and analyze vast amounts of cross-regional, cross-industry environmental information. Data application layer makes use of environmental information obtained at data management application layer, to establish object-oriented business application systems and information service portal, providing decision support for environmental quality, pollution control, ecological protection and other services[4]. The overall framework is shown in Figure 1.
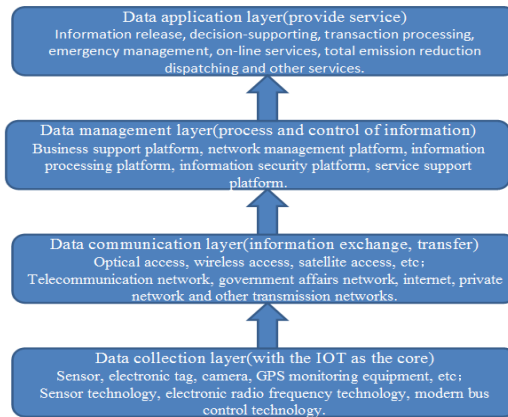
Fig. 1. Overall framework of smart environmental protection. From the bottom up are: data collection layer, data communication layer, data management layer and data application layer.

3   Smart Environmental Management Modes

Smart environmental protection requires not only strong environmental information technology as a support, but also environmental management pattern, organizational structure and business process innovation. This section focus on smart environmental management, organizational structure and mode of operation adapted to environmental concept.

3.1   Comparison with Conventional Smart Environmental Management

Government environmental management business can be summarized as the following three parts: environmental planning, integrated environmental business process, and environmental emergencies management. The main contents of this three-part

business are as follows: Environmental Planning is mainly responsible for zoning, planning formulation, and foundation ability construction in terms of environmental protection, preparing comprehensive environmental function zoning and environmental protection planning, and reviewing specific environmental function division and environmental protection planning. Integrated environmental business process mainly includes the establishment of a basic system of laws, administrative regulations and economic policy in terms of environmental protection, environmental monitoring and information dissemination, and environmental pollution prevention. Environmental emergency management is managing against sudden environmental pollution problems. In traditional government environmental management, environmental information acquisition based primarily on intermittent detection and historical experience judgment, therefore the traditional means of environmental protection is primarily policy formulation and environmental governance. We can say that the traditional government environmental management is post-traceability and passive.

From the overall framework of smart environmental protection we can see, the smart environmental protection gave a new embedded to government environmental management. Smart environmental planning needed to support the planning and construction of the city. Through the collection of comprehensive information on real-time monitoring data, socio-economic, geographic, demographic, cultural, environmental, etc, and systematic structural analysis of massive data, help city managers and business operators understand the tendency of the environment, provide decision support for safety and risk prevention and environmental planning. At the same time, the integration of real-time monitoring of process data can be used to formulate the daily supervision and pollution emergency measures. And smart environment business process integrate different business information system resources through a real-time monitoring of sewage treatment, waste gas emissions, radioactive sources, water environment, atmospheric environment and acoustic environment, to implement administrative office, resource management, business process information into an organic whole, to achieve Daily supervision, process control and resource sharing of environmental quality monitoring information management, construction project approval, reporting and routine supervision of sewage charges, ecological environment management, environmental pollution and other census operations. Meanwhile through the powerful function of GIS, smart environmental integrated business process could manage, display dynamically in a 3-d way and predict its model for the combined results of monitoring network environment information and spatial information, in order to discovery in advance future environmental possible degradation problems and their causes. And help managers master the environment and its associated ecosystems potential threats and temporal trends, then support management decision-making for mitigation or prevention measures. Smart environmental emergencies management can receive timely report when environmental emergencies occur, which can buy time for timely processing. Simultaneously combined with surrounded space information, it can systematically understand the whole process and the possible impact of the incident and improve the timeliness of event processing and scientificity of decision-making for environment manager according to the simulation results provided by scientific analysis. Minimize the losses ultimately[5]. From the supervisor mode given by smart environmental protection, smart

environmental protection management is based on cooperative management of the environmental monitoring data and multi-departments. Through forecasting, optimization, and simulation technology, it realizes initiative smart management. So to say it is a management mode emphasis on prospective.

In conclusion, the advantages of "smart green" application mainly in the following three points: First, it provides a comprehensive and accurate scientific basis for leadership decision-making. Types of "smart green" applications facilitate the inquiries for leadership and staff, and provide convenient services for leadership to keep abreast of the overall situation, the implementation of macro-management and scientific planning decisions. Second, it improves the work efficiency[1]. Application of a new generation of information technology and transmission technology enables staff to quickly take advantage of the LAN business processes, greatly improving the efficiency of environmental management, as well as quickly find sources of pollution for sudden environmental damage events, and make timely countermeasures, reducing emergency response time. Third, it improves the level of services. Through letting people understand the environmental situation and policies, sewage charges and other information timely online, and making it convenient for enterprises and the masses to complete the construction project approval, online reporting, and other services efficiently by the network, it has close the distance to the masses and improved service levels.

3.2   Smart Environmental Operation Mode and Organization Structure

The core of smart environment is not only the construction of environmental information systems, but also how to use it after completion, namely the formulation of operation mode. Traditional government management operation mode is a kind of "minding " approach, and the regulation content of the smart environment is not just the traditional environmental protection business, but also covers water-related affairs, population information, geographic information and other problems related to environment under the jurisdiction of other government departments. It is a cross-organizational operation mode. Our urban smart environmental operating mode is shown in Figure 2. The city should establish an environmental protection supervision center directly led by the municipal government. Urban environmental management supervision and command center can use the data acquired from the deployment of on-line monitoring system, environmental emergency response system, environmental quality management systems and other software, and from the city's resources cloud sharing platform, to conduct intelligent analysis, forecasting and early warning, analog simulation and other applications. Finally serve for environmental protection bureau and the city manager of environmental decision making, formulation of environmental policies and regulations, construction project management, environmental emergency management and so on. At the same time urban environmental management supervision and command center collect the masses of environmental problems from some channels of the website complaints, environmental protection hotline, and media reports, then distribute them to subordinate district of environmental management supervision and command centers. And district center then send law enforcement team to solve the hot environment problem timely.
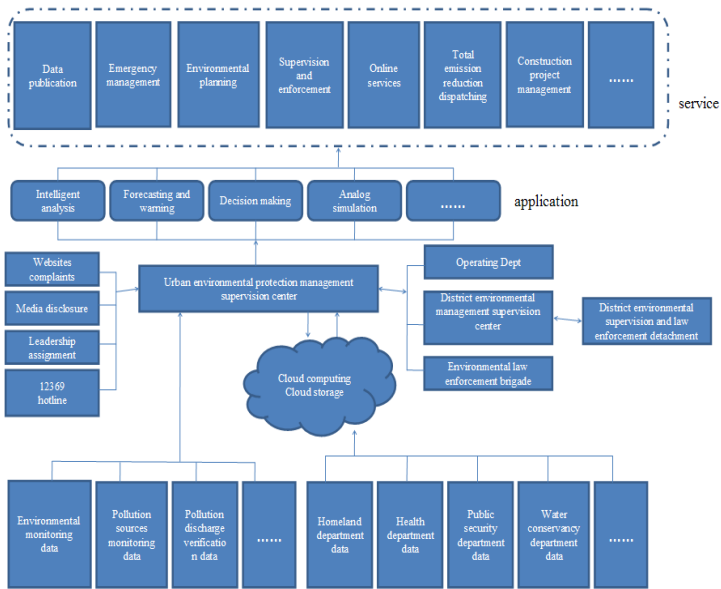
Fig. 2. Operation mode of smart environmental protection in Chinese urban
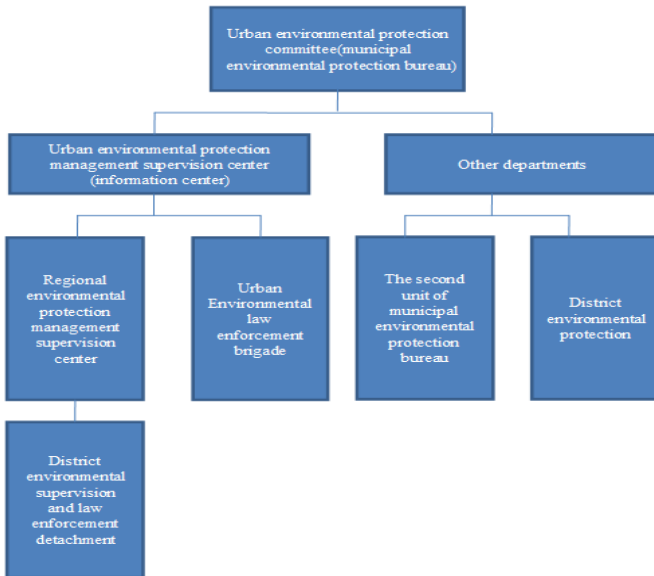

Fig. 3. Organization structure of smart environmental protection in Chinese urban

Therefore, the smart environmental protection management mode is the "two centers, overall command, hierarchical disposition" mode, shown in Figure 3. An office managed directly by the city environmental protection committee and the municipal

environmental protection bureau could be established, whose chairman should be the vice mayor in charge of environment protection of the committee and vice chairman should be the chief of the municipal environmental protection bureau. Its next establish urban environmental management supervision and command center instead of original information center, process or distribute information obtained from smart environmental protection system totally, and carry on environmental law enforcement and environmental emergency management. Environmental management supervision and command center could also be established in every district, and conduct supervision according to the information distributed from urban central. By directly vertical management of the municipal government and entirely command of the center, it can effectively coordinate with other members of the municipal sector and reduce the environmental law enforcement supervision and environmental emergency response time.

3.3   Implementation Advice

Smart environmental protection is a huge project, whose covers are broad, technology is advanced, system is complex and investment is large. It is a long-time task. Its implementation should adopt the principle of overall planning and step by step.

First, strengthen organizational leadership and perfect management mechanism. Any project's carrying out can't do without the leadership's attention and needs enhancing the leaders' environmental awareness of information technology and urgency at all levels. It should set up a special team to formulate management system construction and operation, and effectively implement various construction tasks to ensure the smooth conduct of smart environmental construction. The second is to formulate unified environmental information standards. Through inductive analysis of business data over the years, establish a standardized environmental data standard. All the business systems should follow the unified development standards and technical specifications[6]. The third is to strengthen the network infrastructure. A good network environment is the foundation of all smart environmental protection system. It can modify the existing government network to create environmental protection WAN, ensuring real-time transmission of monitoring data and integration of network resources. The fourth is to accelerate the development of application systems and construction of data centers. Developing application systems should follow uniform technical standards, speed up the development of new smart environmental protection business application systems and integrated into the application platform, establish and improve environmental information release systems and environmental data centers, provide data security and technical support for basic data for advanced application of monitoring information, and increase the level of information sharing and utilization. The fifth is to improve the environmental information security system, establish strict safety management system, at the same time, ensure the safety of the system under the network environment with the application of data backup, duplicate supply, identity authentication and data encryption technology.

4 Conclusions

The new generation of information technology and IOT technologies impels the changes from digital environmental to a new smart environmental protection. This paper introduced the current development of domestic and foreign environmental protection, discussed the overall framework of smart environmental protection, analyzed the different environmental management between the content of traditional and smart environmental protections. We focused on the application of smart environmental management processes and organizational structure. Because fewer environmental studies at home and abroad are available, this paper has great significance in establishing an effective government management processes and innovative organizational structures.

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