

Information Policy and Framework for Environmental Management in Taiwan

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1. Abstract

This paper discusses the information policy and framework for environmental management from Taiwan's perspective. Environmental protection has become Taiwan's important concern in recent years. Since the environmental problems are generally multi-faceted, their management requires consideration of a number of issues, such as sustainable development of resources, the balance of multiple values, spatial analysis, and so on. To address these requirements, information systems and databases are becoming more and more important. The Environmental Protection Administration's experience in information system development is hereby described. It indicates that the use of computer technology in environmental data management and analysis has benefited the R.O.C. Environmental Protection Administration in the past years. The new prospects of information framework for environmental management in Taiwan are discussed.

2. Introduction

Taiwan, one of the larger islands in the southwest Pacific archipelagoes, lies off the southeast coast of mainland China to the North of the Philippines and is primarily a mountainous island with a total area of thirty-six thousand square kilometers. For the last four decades, Taiwan has rapidly transformed from an agriculture-oriented nation to a highly industrialized modern society through the endless effort of the government and the people. The rapid economic development that has taken place in Taiwan has resulted in some undesirable side effects, such as an accumulation of solid and hazardous waste, air and water pollution, and destabilized natural resource systems. While the Taiwan government has taken note of the situation in recent years, many efforts remain to be made to clean up the environment. To create a better living environment, the government is seeking new technologies to improve environmental monitoring and modeling skills. Information technology is one of the technologies that can improve the quality of decision making and raise the level of efficiency in respect to environment issues.

The Bureau of Environmental Monitoring & Data Processing (BEMDP) has been established within the Environmental Protection Administration to carry out the mission of

collective planning for evaluation of environmental quality on a nationwide scale and for the establishment of an information management system. The official duties of the bureau on information management issues are as follows:

1. To integrate environmental quality monitoring and data processing, so as to further establish a decision making support system and to become an instant inquiry center for nationwide environmental protection activities.
2. The establishment of a nationwide Environmental Protection Administration Information System and Environmental Protection Databases.

3. Overview of the Current Status

Hardware/Software equipment

The administration employs the VAX 6420 system, which is connected to 66 air monitoring stations around the island. Oracle RDBMS is used for monitoring data management. Most information systems that support the daily work of the administration employs an IBM 4381 system with FOCUS DBMS. Also, a Netware PC-LAN which is attached to about 120 PCs (to be expanded to 300 PCs by Dec. 1994) provides a data sharing environment. Software

packages such as spreadsheets and word processors are widely used in the administration offices.

Since the geographic information system (GIS) can provide a powerful environment for the management and integration of various kinds of data, the administration uses HP workstations and an ARC/INFO package as a platform for the development of GIS applications. Attribute data and spatial data are closely managed by ARC/INFO software.

Above systems are connected by a local area network with three segments. Communication servers are attached to the local area network for remote file transfer, jobs and electronic data interchange messages routing.

Framework of the system network

Owing to the extensive nature of environmental protection issues, and the urgent need for swift and accurate information, a Nationwide Environmental Protection Information Network (NEPIN) was established to meet the occasion. Through a Digital Telecommunication Network, the NEPIN allows the departments of environmental protection of the Provincial Government, Taipei and Kaohsiung Municipal Governments, the environmental protection offices in various cities and counties, and relevant academic institutes, to exchange information. In June of 1994, the EPA also established a link with the Internet. Through the network, the administration can communicate with environmental protection institutes in more than 120 countries on environmental protection issues.

Information systems for environmental protection

Based on the IBM/BSP (Business System Planning) methodology, a framework of the environmental protection information systems (EPIS) was built as a blue print for long-term development in 1989[3]. The EPIS, covering databases for environmental quality, pollution control, basic environmental data, and administrative support, consists of more than 20 subsystems at present.

Some of the specific information systems, such as environmental CAI and the regulation retrieval system, were developed to assist in environmental education and policy planning. Also, the administration implemented an air quality monitoring information system that was dedicated to dealing with the gathering of data from 66 air monitoring stations.

Since 1991, the administration has begun to promote business with the technology of GIS and was in charge of the planning and convening of nationwide environment quality databases for the national GIS project in Taiwan. We have made some remarkable achievements in spatial data collecting and application implementation at present.

In sight of the wideusage of computers in the society, the Administration has made it a strategic plan to share environmental information among the industries, the public, and the environmental agencies by promoting electronic data interchange (EDI) application.

4. Development strategies and related programs

Since many of our information systems are functional development and not well linked, we have made an integrated plan to improve current status. Some strategies in the plan are as following:

Constructing an integrated environment geographic information system(EGIS)

The environmental management places heavy emphasis on spatial data and analysis. We will develop an integrated geographic database that could well communicate with other databases[1]. Several development guidelines are as following:

i. Multisource data acquisition

The first steps in developing the database for a geographic information system are to acquire the data and to place them into the system. Data to be input to a GIS are typically acquired in a diverse variety of forms and EGIS must be able to accept a wide range of kinds and formats of data.

For example, we employ GPS technology to locate the location of pollution sources, and we also utilize remote sensing data to get information about properties of the Taiwan's surface over large area.

ii. The standards of EGIS

The standard of EGIS is one of the most important issues. All EGIS applications must be implemented in accordance with appropriate standards for software, hardware, data and other components. The EGIS standards need to be established include:

- Classification and encoding system for environmental data
- Symbols and legends for map features
- Data interchange formats
- Data qualities and its evaluating procedures

Other standards consideration might include: spatial data management system, software programming language, queries language and so on. The administration should also use existing practical experience with other agencies in Taiwan (e.q. Ministry of Interior, The Research, Development and Evaluation Commission), industry and academia to develop standard that promotes the effective use of GIS technology and facilitates access to GIS capabilities by program offices. All EGIS standards should fit the demands of National Geographic Information System (NGIS) project which started in 1990 by Executive Yuan.

iii. Mission-based application system implementation

The implementation of EGIS application systems should be fitted for the objectives and activities of program offices in the administration. In beginning to implement a EGIS application, a thorough analysis of system requirements should be done by BMDP and program offices. It also should identify what are the anticipated benefits of the application systems (e.q. workload, decision-supporting, and enhanced management).

Since GIS are a dynamic system, a detail planning for the data updating and revision should be carefully evaluated before the implementation.

Constructing a nationwide environment information network

Architecture of current NEPIN will be renewed and a nationwide environment information network will be constructed. The administration will try to link with all the environmental protection offices in various cities and counties around the island via TCP/IP through X.25 protocols. In the administration, we will construct a client/server environment to suit the needs of individual departments and users. We also try downsizing some applications in the mainframe to the LAN-based platforms.

Promoting environmental information exchange using EDI technology

EDI offers the best method for the environmental agencies and their regulated communities to exchange data electronically. Here we introduce from our experience the benefits, the implementation strategies, and the candidate applications to environmental protection of employing EDI technology.

i. The benefits of EDI

- Reduced manpower needed to process reports
- Improved flow of data
- Improved data quality
- Reduced costs associated with management of information

ii. The strategies for implementation of EDI

- Rapid prototyping methodology
- Table driven translation software
- Allow the transmission of data in Chinese
- Joint efforts of the government agencies and the industries

iii. Candidate applications for employing EDI technology

- In the air quality control

Stationary pollution sources compliance and emission reports submitting program

Application for the certification of air pollution control equipment

Ambient air quality data interchange

- In the water quality control :

Stationary pollution sources compliance and waste water discharge reports submitting program

Application for the certification of waste water and sewage treatment facility

- In the solid waste control :

Industrial waste clearance/disposal management program

Export/import industrial waste management program

Solid waste disposal sites (plants) operation management program

- In the others:

Toxic chemical substance management program

Chemical accident prevention and emergency response program

Public nuisance inspection program

International environmental data interchange

For the development of EDI application, we first established guidelines and standard messages following EDIFACT (EDI for Administration, Commerce and Transport) first convention. An Environmental Standard Message Working Group was formed under the Taiwan EDIFACT Board in March, 1994. The promotion of the application of EDIFACT message for environmental information interchange in Asian area is one of the major goals of the working group. To set a foundation for EDI applications, we are developing a pilot EDI application for electronic reporting of stationary air pollutants emission monitoring monthly reports

Establishing software quality assurance procedure

The function of software quality assurance (SQA) is responsible for uncovering bottleneck to the achievement of quality and uncovering

product and process defects[2]. Software systems and the environmental problems they solve today are increasingly complex. The administration tries to synthesize software development techniques into an engineering discipline. Some issues of software development will be changed and enhanced, such as:

- Software development management
- Formal qualification test
- Software product evaluation
- Software configuration management

5. Conclusion

Economic development in Taiwan has resulted in very complex environmental problems. Due to the complexity of environmental problems, we need the ability to gather and manipulate immense amounts of data in an effective way. The R.O.C. Environmental Protection Administration is just beginning to address the questions of distributing and integrating its information management system. Information technology changes to accelerate, as it always will. New hardware and new software continually provide opportunities for doing things better and cheaper. Yet there still many challenges await us. The administration will associate with other government agencies, environment management experts, and researchers to create a shared-data, integrated information environment to improve the effectiveness of environmental protection programs and subsequently improve the quality of our living environment.

6. References

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