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E-government Systems and its Application in Public Project Management

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Abstract: The essential entities and information flows of the E-Government system of public project management are analyzed, the theory of comprehensive management was used, the system function model, data model and system architecture are studied and designed respectively and the information system of project Management for inland waterway channel renovation is illustrated as a practical example.

Key words: Public project, E-government, project management, total management

INTRODUCTION

Public projects invested by financial department are generally organized, constructed and supervised by government. Apart from the characteristics other projects having as well, those public ones always gain more attention concerning their equity and function effectiveness because of the specialty they have (Ao and Jin, 1998; Anderson, 2003).

Traditional management methods are already incompatible with public projects management, which can be concluded from those phenomena such as the great number of work waiting to process, the overloading workers, the inefficiency of human-centered management that cause many work lag behind, the various data and paperwork that confuse management persons as well as the unavailability of an simplified and efficient managing team and institution (Bradley *et al*., 1995; Browne *et al*., 1995). Problems concerning quality accidents, delaying of accomplishment and overspending money are consequences of the impediment existing in communication channels and the experience-centered managing methods. Many serious public projects accidents and corruptions not only resulted in the great loss of public resources but generated negative social influence. In recent years, some public projects like road and water conservancy have begun their exploration on the information system of projects management and the related E-Government system which is equipped with the functions of information channels, office automation and archives management. However, the E-Government system compatible with public projects management is still unavailable (Bensaou, 2001; Camarinha-Matos *et al*., 1998).

Based on the analyses of public projects management information and information flow, this paper applies comprehensive management methods to analyze and design the constitution of a well developed E-Government system for public projects, brings a systematic data system and design method, works on system structure as well as illustrates how it works with an example (Cooper and Zmud, 1990; Cox and Ghoneim, 1996; Dou, 2003).

PUBLIC PROJECTS MANAGEMENT INFORMATION AND INFORMATION FLOW

The main elements concerning a public project include government administrative department, project department, project undertaking units for designing, supervising, constructing, local government, the public there, etc. Government administrative department is the sponsors for public projects and they directly supervise projects, regularly checking work progress (Fichman, 1992; Gunasekaran, 1998; Inmon, 1996), construction funds and quality. Project department represents government administrative department and perform proprietor's responsibility. It is in charge of bidding, contract management, work progress, funds, quality and compensation management as well as handover and accomplishment management. According to construction situation, project department makes conformation on

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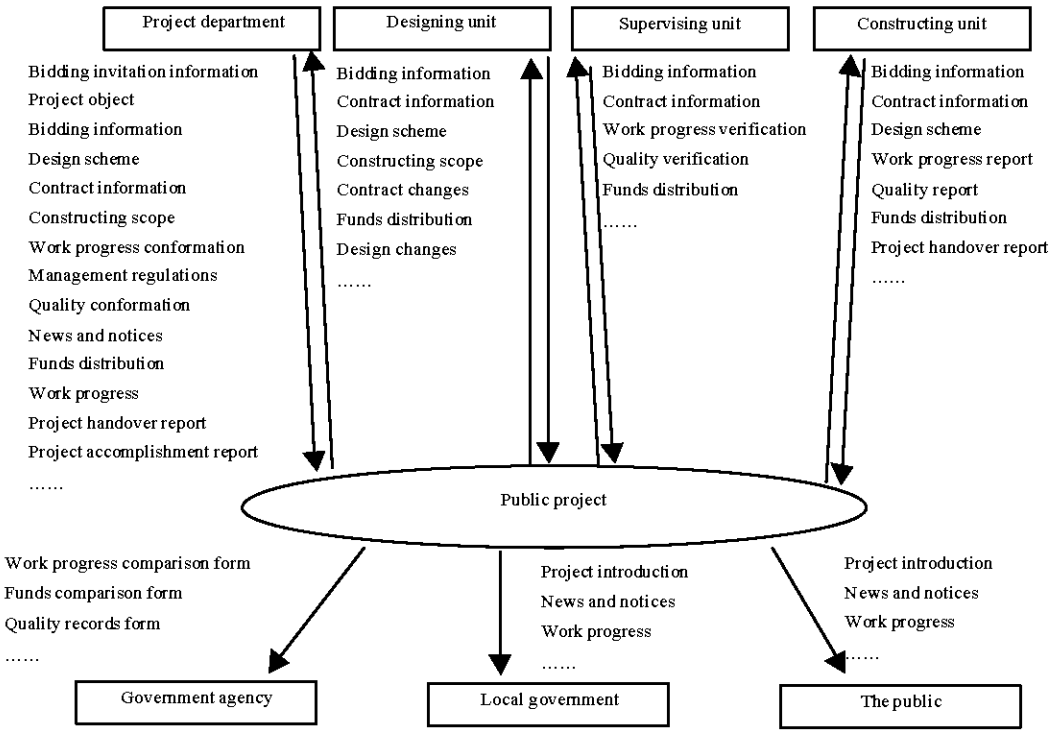

Fig. 1: Public projects main information flow

quality and work progress, provides required funds, asks for compensation if necessary, checks and accepts accomplished projects and reports work progress to government administrative department in time. Units for designing, supervising and constructing are identified in bidding and they are supposed to accomplish their tasks and get paid according to contract. Local government and the public concern about what influence on environment and economy those public projects may bring to them as well as the necessary business and affair openness, equality and fairness (Orlikowski and Baroudi, 2005; Prescot and Conger, 2004; Si *et al*., 2003). Figure 1 shows those main information concerning public projects.

The difficulties existing in public projects are due to the great number of information coming from related elements. During construction process, it is required for project department and those units for designing, supervising and constructing to communicate with information concerning projects in time. Government administrative department, local government and the public need information services from various aspects, which means those information is supposed to be provided to various people with different needs (Walsham, 1995; Xu *et al*., 2005; Zhou, 1999).

The main information flow influencing public projects management include the outward information flow between project department and project undertaking units, the upward information flow from project department to government administrative department and another outward information flow from project department and the public. The first flow, such as information flows of bidding, work progressing, fund providing and compensation claiming, records, reflects, coordinates and controls public projects' logistic situation and capital flow; the second one, such as comparison figures for work progress and expense as well as the statistic form of project quality, provides macroscopic and integrated information services for public projects and the third one, such as project introduction, notices and news and work progress, offers visible and dramatic information services (Kwon and Zmud, 1987; Larsen and McGuire, 2004; Noori and Mavadda, 2003).

PROJECT MODEL

Project function model: Considering time and relevant elements, the concept of integrated management emphasize scheduling before starting, recording and

controlling during work progress as well as concluding and analyzing after accomplishment. This concept has been applied to many management areas and has oriented the concept of integrated quality management, integrated schedule management, etc. Based on integrated management, public projects management is able to make its goal of properly using public resources, improving management ability and enhancing ministry supervision by satisfying related people or groups' needs. Therefore, viewing from government aspect, sound public project management requires not only every unit working by contract but their communication and coordination as well.

Given these analyses above, following problems concerning E-government system of public project need to be solved:

- To achieve the coordination and control for integrated management, the steps of project management, such as bidding, working process management and compensation claiming, need to be realized
- To realize these project management steps, project information is supposed to be collected and transmitted to ensure hose related elements to get and check required information
- To meet the requirements for public project management, this system can be regarded as two sub-systems, thorough steps management sub-system and multi-aspect information service sub-system.

Thorough steps management sub-system: Based on the contract, this sub-system focuses on work progress, funds management and quality management, entirely supervising all the activities concerning project management steps (Fig. 2). The main functions of this sub-system include data collecting, transaction processing and information sharing, which helps to enhance information communicating and improve management ability.

Thorough information management: Project department needs a sustaining information system from project's beginning to end, not a system only serving certain steps or aspects. From bidding till project accomplishment, this sub-system is supposed to function in all transaction process and management to make sure the data in every step are colleted, processed and used, if necessary, for later steps, which all contribute to a high efficiency in work and management.

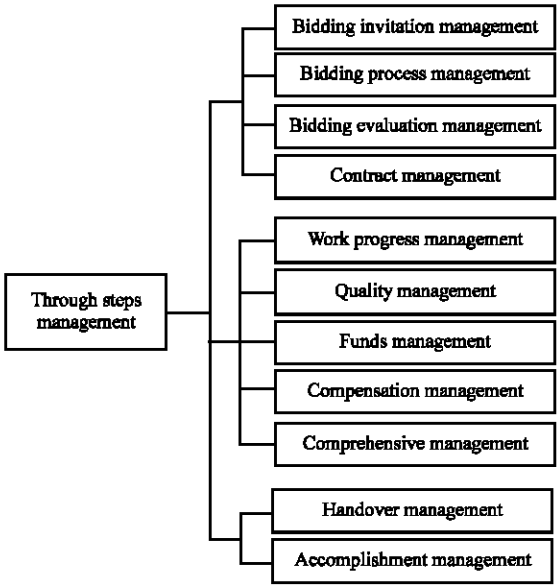

Fig. 2: Thorough steps management sub-system's function

A flexible management standard: Different public projects have different management standards. For example, project rating system needs to have a comprehensive consideration on subjective and objective factors, such as project characteristics, quality requirements and expense limitations. Therefore, it is quite hard to have a fixed list of factors for project rating system. This sub-system accommodates these differences by revising these factors if necessary. This revisable rating system allows clients to define and use different rating factors and scoring methods according to their needs. Therefore, project's management systems for construction, location, quality, etc, are supposed to have such revisable factors to make the system more flexible.

Strict process control: Project management has a series of activities and steps and each step is closely related to the next one. For example, the step of funds distribution needs to consult the results of activities concerning contract, quality, work progress, etc. Before such consultation, rational decisions can hardly be made and only relying on experience always make decisions mistakes. This sub-system applies process control to guarantee this sequential relationship among steps. For example, it defines the activity of funds distribution as "quality conformation of accomplished projects→work progress conformation of accomplished projects→contract checking→contract changes checking→funds distribution recording checking→sources of funds checking→funds distribution amount and date

checking→funds distributing→conformation of receiving money", which improves decision accuracy. Therefore, many activities, such as quality conformation, work progress conformation and acceptance of accomplished projects, can be defined as process, making management more scientific.

Support of long-distance transactions: Public project's clients spread in a large area and they make public project's long-distance work quite necessary. This system provides the function of long-distance transactions, supporting construction units to report work progress and quality information form a long-distance and allowing supervising department to deliver orders on-line and transmit those information to project department in time. This system also supports project department's telecommuting, dealing with project management affairs as well as delivering work orders.

Multi-aspect information service sub-system: To satisfy different element's needs for information, this sub-system provides information services from various aspects. Therefore, its main tasks are to provide information inquiry services for related elements and design data warehouse for these services by adopting proper expressing methods, which aims to enhance management transparency and improve information services.

This sub-system provides different information services for different client groups. For example, it offers contract execution information, schedule comparison information and so forth to government administrative department, providing inquiry services on dates, contracts, construction units, etc., to enable clients to supervise projects. It also informs the public with projects introduction, project news, work progress, etc., offering inquiry services on project's construction items, geographic information and other aspects to make clients have a better understanding of projects.

To achieve a more transparent administrative management, this sub-system offers comprehensive information services. Clients have access to all information from bidding to project accomplishment, which includes a comprehensive outline for bidding affairs, work progress percentage, quality examination, handover percentage, accomplishment certification, etc. Clients can also get various information concerning project, such as management regulations, bidding invitation and project constructing news.

In order to offer direct and dramatic information services, this sub-system is supposed to adopt various ways for information expressing. For example, besides statistics charts, bidding situation can be represented by using histogram, work progress by Gantt chart and handover percentage by cake chart. In addition, project ichnography, photos, audio and video methods can be adopted as well to introduce projects.

Data system construction: To realize thorough data management and multi-aspect information management, the date system of E-Government system of comprehensive public project management, is supposed to be consisted of the data warehouse of current public project, the data warehouse of all public projects and the data mart that provides management information from different aspects (Fig. 3).

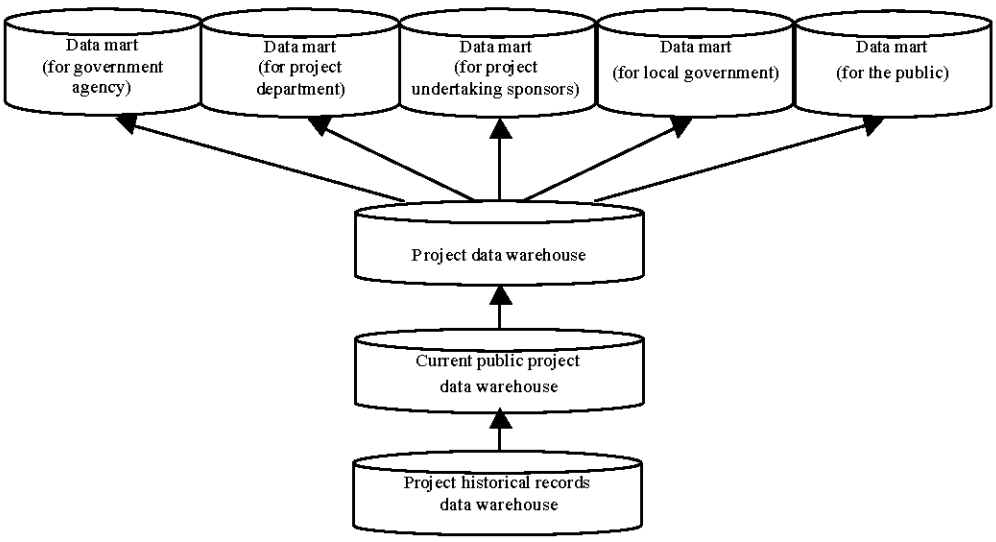

Fig. 3: Data system construction

The public Project construction level, project supervision and management level, sponsors qualification, work progress. In Fig. 3, project data warehouse memories all the information concerning current project, such as bidding invitation, process, closure, evaluation and identification, project design, construction, funds distribution, compensation claiming and accomplishment, etc. According to projects' concerning topics, Project data warehouse stores all information of public projects, including projects' constructing information with different granularity. Data Mart should be built according to relative elements' decision-making requirement and information needs. Therefore, to identify those topics that different elements concern is of most importance in building up systematic data system. Topics focused by different elements are listed in Table 1.

SYSTEM STRUCTURE

The structure of G-government system of comprehensive public project management is shown in Fig. 4.

In Fig. 4, project data warehouse, data mart respectively for project undertaking sponsors and project department are connected together by the Intranet in project department, which provides convenience for current public project's data collecting and processing and guarantees highly efficient and comparatively independent project management. The data mart respectively for government administrative department, local government and the public, project historical records data warehouse, project data warehouse are combined together by the Intranet in government administrative department, offering the information concerning public

Table 1: Public project topics

Elements	Topics
Government administrative department	Bidding statistics, process statistics, quality statistics, funds estimate and statistics on how much has been used, handover and accomplishment statistics……
Project department	Comparison of different undertaking sponsors' construction process, comparison of quality information, comparison of funds distribution, comparison of handover and accomplishment ……
Sponsors	Comparison of work progress, quality, funds declare and conformation, comparison of compensation claiming and approval, comparison of handover application and acceptance ……
Local government	Project geographic distributing, sponsor distributing, work progress……

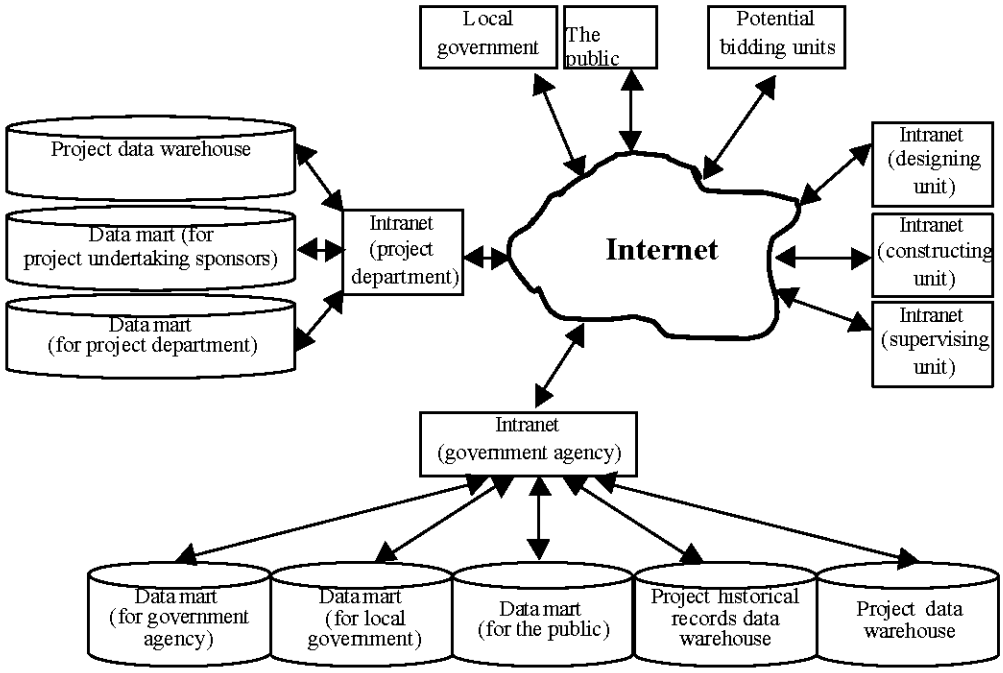

Fig. 4: Structure of E-government system of public project

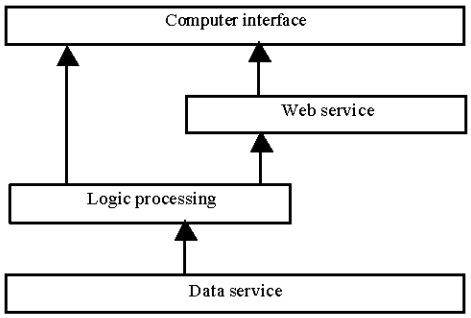

Fig. 5: 4 C/S System structure

project's stability and information aiming to communicate with supervisors and external world. It makes data drilling and mining more convenient and offers a solid data support for multi-aspect information services. Project department's Intranet and government administrative department' Intranet are all connected with Internet, which not only provides convenience to connect project undertaking sponsors' Intranet and achieve better coordination but make the long-distance visit much easier for potential bidding unit, local government and the public as well.

To support the system structure in Fig. 4 and its function stated above, this system applies four-layer C/S calculating model (Fig. 5).

The first layer is computer interface. Different computer interfaces was designed for different client groups. For example, the clients in government administrative department focus on whether project process compatible with contract, so the interface for them can adopt a style of Gantt chart, marking and emphasizing project's work progress percentage, funds ratio and excellent quality ratio as well as offering directions for detailed information concerning project. Public clients, those ordinary people using public project, do not have a deep understanding of such project. Therefore, the ichnography, functioning as direction map, can be designed as the computer interface for them, providing a large number of information concerning project introduction, news and notice, pictures, videos, etc. for public clients.

The second layer is Web service. It processes long-distant clients' business connections and provides information services. For example, when a constructing unit needs report a quality record at constructing spot, this information is supposed to be checked and processed in computer interface layer, then, a process method or a function would be chosen from logic processing, the third layer, to process the data for data-recoding. When layer of logic processing work is done, feedback information firstly reach web service layer and it chooses a method or function to deliver the information with proper computer interface.

The layer of logic processing deals with specific logic affairs, including data maintenance for bid documents, contracts, work progress, funds, quality information, etc., as well as data analysis of work progress comparison, funds comparison and quality records. Meanwhile, responding clients' information inquiry is also in this layer's working scope.

Data service, the fourth layer, works on data reading, writing and storing. For those structured project data, such as work progress, funds, quality, etc., relational data warehouse is adopted as storage media, while for those unstructured mass media contents, such as photos, videos, etc., data file is adopted. Distributed data warehouse takes project department's data warehouse as central data warehouse, then periodically uses hard disk, Internet transmission and other methods to copy itself to a well connected Internet center which is regarded as long-distance data warehouse. In addition, Web server is provided to offer the public Internet services with a series of safety precautions. The adoption of distributed data warehouse offers high-speed data accesses within an acceptable allowance for data delay. Meanwhile, the safety of central data warehouse is guaranteed, for Internet clients do not make direct visits to central data warehouse.

Four-layer C/S calculating model effectively reduces the degree of coupling in system module and ensures the system with excellent integrating capability and extended capability. In this way, efficiency, safety and openness are all achieved. Such model guarantees operating efficiency and data safety in project department, while supporting long-distant clients' immediate and thorough communication with system.

EXAMPLE AND CONCLUSION

Inland waterway channel renovating project is a kind of water transportation public project, which aims to enhance sailing condition and improve sailing route standard. It is sponsored and invested by government transportation department and its constructing spots spread along the route. Ship selling companies and the local public along the route have a demand on information concerning project.

Given the function model, data model and system structure that were illustrated above, in order to improve project management level and realize government affairs' openness, Power Build and Microsoft Visual Studio. Net

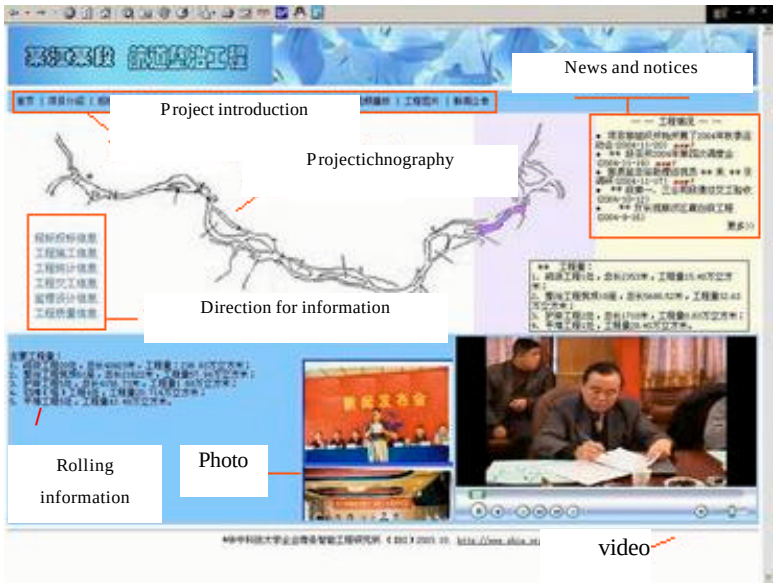

Fig. 6: Computer interface for public

are adopted as exploring tools, Microsoft SQL Server as data warehouse management system and E-Government system is developed.

Figure 6 shows the computer interface for the public provided by multi-aspect information service model. The most emphasized part in this interface is project ichnography which provides directing services. It makes clients have a direct understanding of project outline as well as find what they are interested in quickly. The information direction at bottom left corner of project ichnography provides clients with further specific direction on project's bidding information, constructing progress, project quality record, financial situation, etc. These information are provided with statistical chart of macro granularity. The project introduction part on the top of Fig. 6, news and notices part on the right and the photo and video part at bottom comprehensively use various expressing methods of media, such as text, short message, picture and video, which enhances clients' understanding of project.

This system has brought efficiency. It simplifies and improves data collecting and paper processing work in project department's daily affairs management, making administrative officers now have more time to deal with constructing work progress, funds control and quality management, which improves project management's efficiency and level. Meanwhile, the long-distance inquiry and mass media analysis on project management information are offered on Internet, which allows administrators and ordinary people to be informed immediately, directly and macroscopically with project situation, support long-distance communication for constructing units, supervising units and project department, creating an excellent information technology supporting platform for public project.

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