

## **Developing a Common "AEC" Extranet for Regional Networking of Professional Practice**

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### **Abstract**

In the light of the increasing need for an effective IT system to foster effective project communication and integration, this paper study the development of an integrated extranet system prototype for the construction professionals (architects, engineers and contractors) in Hong Kong and nearby region. The system (referred as *e*-AEC) aims at achieving technological and organizational integration. The paper examines how it can be used to support the construction industry, which has been slow to adopt Information Technology. The requirements that form the basis for the construction and development of *e*-AEC prototype have been identified, which fall into the grouping of information database and interactive services. With the advent of extranet technology, the "AEC" extranet platform has lot of room to improve services to the industries, which are beyond the boundary that traditional media can offer.

### **Keywords:**

Construction industry, Extranet, Information technology, Prototype, Communication

### **1. Introduction**

The construction industry is characterized by its fragmented nature, which is a result of the temporary multiple organization (TMO) structure and the maximization of self interests (Walker 1996). Indeed, the situation is worsened by the increasing competitive and complex construction activities, factors including market force, technology push, organizational culture, globalization and quality-within-budget make the issue of integration of various phases of construction process more critical than ever (Graham 2000, Mitropoulos and Tatum 2000, Schimming 1993). As such, there have been calls for traditionally fragmented construction organizations to take the initiative of coordinating intra-organizational functions and activities (CIRC 2002, Nam and Tatum 1992, O'Brien *et al.* 1995). In recognizing such a need, a number of project management techniques and commercial products have been designed and promoted. They share the common intention of improving the integration of project members. Some of the more notable examples are partnering charters, team-building exercises, and the use of IT (CIIA 1996, Latham 1994, NEDO 1991, Newman 2000). It is the use of IT in the construction process that forms the basis for discussions in this paper.

It is only in recent years that the use of the IT, particularly the Web, has actually entered into the construction industry practice. In fact, there remain practical barriers that tend to restrict the development of IT in the industry, including resistance to change, lack of IT skills and training, technological risks, and initial set-up costs (Tatum 1989). Contractor firms have been reluctant to adopt IT, in particular those components of information and communication technologies related to computer-integrated construction (University of Glamorgan 2004). Previous surveys of construction contractors in the US and UK suggested that there is a general lack of enthusiasm on the use of IT in the construction project environment (Ahmad *et al.* 1995). This view is supported by the studies of Skibniewski and Chao (1992) that the industry requires a new way of thinking about IT in practice and it may involve organizational-structure changes.

In recent times, advanced shared-resources systems, including the electronic data interchange (EDI) system, knowledge-based database system and project extranet have become popular (Ahmad *et al.* 1995, O'Brien *et al.* 1995). Regardless of the approach adopted for achieving project integration, communication tools are indispensable. The greater the level of collaboration, the higher the level of coordination required (Abduh and Skibniewski 2002). Therefore, to achieve inter and intra-organizational coordination in a typical construction project, concerted efforts and commitments from all project participants, including the client, architect, engineer, quantity surveyor, and contractor are needed. They must be able to share information about their operations, and, in so doing, a communication tool that facilitates information-sharing in a secured and private way is essential (Aouad and Price 1994, Brandon 1992).

## **2. Extranet System**

Project Extranet can be described as a secured Web page, which is specially designed for team members for the contract duration where important project data and records are contained, and business functions are provided. It appears that an online project extranet system fits nicely with such a need. A project extranet is a private network that uses the Internet and the public telecommunication system to securely share part of a business's information or operations with partners or other businesses. In practice, the use of project extranet allows disparate members of the project team to work efficiently, hence reducing administrative burden. In addition, with greater control and faster turnaround of information, it means that projects can be delivered on time with improved quality control. This is considered as a new method of communication between project members. With the new way of communication in a project environment, it has been suggested that project extranets will become the standard platform for achieving effective construction (Ahmad *et al.* 1995, Howarth 2003, O'Brien *et al.* 1995).

For commercial activities in the Greater China region, with constant contact with the latest international practice information while physically situated in China, it is an invaluable asset for international construction companies. A number of international construction companies have embraced this system because of its competitive advantages or they are required to adopt it by their clients (Abduh & Skibniewski 2002). Broadly speaking, for a typical construction project, there are two strategies that the project team can choose in developing a project extranet; either developing the system by an in-house IT team or outsourcing this activity to a consultant. For the former strategy, a number of considerations should be taken into account, including the availability of financial, technical and human resources, the set-up and maintenance costs and other related expenses. The project team could set up a Web server and customize it to fulfill the project operations through commercial service providers. Jurewicz (2004) has summarized the major service providers of extranet for the commercial construction industry, including Meridian, Constructware, Citadon, Brisnet, Buzzsaw, Primavera, and Bentley. For the latter strategy, it is preferable for companies with limited resources to develop their own extranet systems; hence 'outsourcing' is the better option. Many Internet-based information services for the construction industry provide a capability to build one's own web residing on the provider's server. For example, Active Project™ from Framework

Technologies, and e-Builder™ from MP Interactive have established extranet project services (Skibniewski & Chao 1992).

## 2.2 The Preliminary Framework of the Model

“e-AEC” stands for a project extranet platform for architects, engineers and contractors. The proposed “e-AEC” Extranet platform acts as a problem solver offering extranet solutions (application services) to the AEC industries. With the advent of extranet technology, the “AEC” Extranet platform has lot of room to improve services to the industries, which are beyond the boundary that traditional media can offer. In the long term, the “AEC” Extranet model resulted from this research will be developed to host various kinds of application in its servers to be shared across the internet to different users anywhere and anytime in the Greater China region. Figure 2 is the proposed framework of e-AEC.



Figure 2 Proposed Framework of e-AEC

## 2.3 Use of Project Extranet

Project extranet does not replace proper implementation planning. Strategic direction and supports from project members throughout the construction process are still required and there is a need for on-going review and continual improvement. Indeed, there are barriers to overcome for the use of project extranet. Firstly, people are not willing to change and the introduction of a project extranet system can be a culture shock to some people. Some may be intimidated by technology and not geared to working with IT. There may be conflict with existing systems and duplication with current practice. As such, project management should spent time with members to understand their concerns and try to get buy-in from all involved. For example, the project management team agrees with the sub-contractors that they will use the system. Regular training workshops should be organized to get the frontline staff involved. A number of barriers to the effective use of project extranet have been identified by the interviewees and summarized in Table 1. Some of the more salient issues are: current work practice culture, cost issues, a general lack of IT knowledge and training.

The contents or the functions of the project extranet should be so designed to achieve effective team work and project communication, hence to allow: 1) fewer meetings through internet communication and collaboration; 2) savings in document filing/copying; 3) reduce errors and wastage; 4) recycle information; 5) make available the latest industry news and knowledge; 6) review project performance; and 6) reduce overall project expenses and life cycle costs.

**Table 1 Summary of Barriers to Effective Project Extranet**

**Barriers to the effective use of Project Extranet**

- Speed of connection
- Current work practice culture
- Integration of systems between team members
- Many parties involved
- Team members having different degrees of IT knowledge
- Familiarity and reliance upon hard (paper) information
- Lack of access to project data over the Internet
- Increased cost contribution required from sub-contractors
- Conversion of information to suit digital format distribution
- Long term benefits difficult to quantify
- Legal issues
- Security issues
- Lack of awareness of the benefits of Project Extranet

**3. Key Components of the Model**

The model basically consists of four key components: user identity verification; main functions; data output; and potential plug-in systems. For information protection and security reasons, project user's identity verification is important in order to control access to the project extranet server and databases. To facilitate the identification process, each project user is assigned a Personal Identification Number (PIN), which is designed to contain 6-digits to reduce risk of 'hacking' by outsiders. In this connection, a password encryption system is installed to further improve protection. Electronic certificate will be employer for identity verification in transactions.

The main functions provided in the *e*-AEC are: engineering and building database; electronic data interchange (EDI), online forum, and hyperlinks to relevant homepages. The database covers a host of information databases, including construction legislation, construction standards, and dispute resolution model. For example, construction-related practice notes, technical memorandum, ordinances, codes of practices can be found in this section. This serves to provide references in relation to the contractual and legal matters in the construction process. The inclusion of the EDI is to enable speedy transfer of project data (i.e. drawings, images, and documents) between project members, whereas the online forum is a platform designed to enable online discussions and exchange. While the hyperlinks serve as a mini directory

of relevant construction and building sites by making reference to important homepages closely related to the industry, such as links to some of the institutions, Government authorities and products suppliers are provided.

The system designed to be compatible with other potential systems which have not been yet been incorporated into the system. These potential plug-in systems have been identified by the interviewees, including e-procurement, e-tendering, enterprise resources planning (ERP), accounting system, and cost and planning system, and CAD drawing system.

#### **4. Ways Forward**

It is anticipated that the above-mentioned model will be refined as required and appropriate. Case studies could be carried out by following through 3-5 cases of projects in Architects/Quantity Surveyors/Engineers consultant firms to evaluate the actual needs and practical difficulties in utilising the proposed model of “AEC” Extranet. To ensure the reliability of the research findings, the on-line extranet system developed should be validated through a seminar with an independent panel with practical experience in IT and construction knowledge. The selected experts are welcomed to make suggestions for refinement and improvement. Comments would reinforce the applicability of the research system in practice. The model will be refined taking into considerations of comments from panel discussion. The ultimate aim is to produce a system integration service or use by the construction industry in Hong Kong and nearby region. In particular, the model aims to help those who are involved in partnered projects and international construction projects where good communication is of essence.

#### **5. Conclusion**

The e-AEC project extranet system is designed to foster a more effective communication among architects, engineers, contractors, and related construction professionals in a construction project environment. The paper has identified the current needs of the construction industry and to develop an on-line extranet model (web-based application) that enables construction professionals to communicate, share of the latest information and conduct activities in real-time over the internet. It has reviewed the IT capabilities that can be used for this project. It also has evaluated the characteristics and the needs of the construction professionals to use on-line extranet. In essence, the construction professionals would like to see a project extranet system that provides several IT functions, including online forum, electronic data interchange (EDI), databases of building and engineering related documents, and hyperlinks to other related sites. It is based on these requirements that the schematic model of the e-AEC has been designed and developed. It is anticipated that in the long term, the “AEC” Extranet model resulted from this research will be developed to host various kinds of application in its servers to be shared across the internet to different users anywhere and anytime at least in the South-East Asia region.

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