5. A PROPOSED IT-BASED APPROACH FOR MANAGING THE CONSTRUCTION BRIEF EFFECTIVELY

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Abstract:

The present paper gives a comprehensive overview of the CoBrITe[1] project. First, the aims and objectives of the project are described, followed by a detailed definition and characterization of the briefing process. Then, an overview of the current technology implementations of the CoBrITe industrial partners is given. The paper also introduces five key areas that can promote effective briefing: Communication, Information capture, Information referencing, Information representation, and change management. Finally, the CoBrITe system demonstrator is presented. The project is ongoing and supported by the Link / IDAC program.

Keywords: Information Technology, Client, Construction, Briefing.

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[1] CoBrITe is a research project funded by the Link / IDAC program involving two academic institutions (Loughborough and Salford University) and seven industrial partners (AMEC, BAA, Boots, BDP, Nuffield Hospitals, and WS Atkins)

BACKGROUND

A wide range of problems are encountered during the briefing stage of a construction project. There is little guidance and support for clients, whilst designers have difficulties both in capturing clients' needs and conveying conceptual design options to them. There is a central difficulty, associated with language, communication and the exchange of information between clients and design teams, which is now gaining widespread acknowledgement (Hassanen and Bouchlaghem, 1999).

The CoBrITe (LINK/IDAC UK funded) project argues that the construction industry has yet to exploit the potential of IT systems to assist both parties during this critical phase. This is in contrast to later stages of design and construction where computer-based techniques and systems are commonplace. The overall aim of the CoBrITe project is to improve the briefing process through more efficient and effective use of existing and emerging information technologies that can support client and design teams.

A variety of definitions of briefing can be found (BSRIA 1990, CIB 1997, BRE 1987, BS-7832 1995, and CIRIA 1995). Consultants tend to consider the briefing process as a limited process with well-defined start and end to ensure records of changes in order to be able to claim fees for any extra work. On the other hand, clients prefer to consider the briefing process as extended until almost the final stage of construction to ensure that the final product meets their requirements and fulfil their objectives. Barrett and Stanley (1999) defined the briefing process as "the process running throughout the construction project by which means the client's requirements are progressively captured and translated into *effect*".

The agreed definition of briefing within the CoBrITe project is as follows: the process running throughout a construction project by which the requirements of the client and other relevant stakeholders are progressively captured, interpreted, confirmed and then communicated to the design and construction team. This definition is believed to be more suitable as it widens the customer base; emphasises the cyclic nature of understanding what is really needed; and delineates briefing activity (which must always involve deliberation of needs/requirements and therefore involve the stakeholders in some way) from the design activity which produces potential solutions in response to the brief (Hassanen and Bouchlaghem, 2000).

A comprehensive literature review of briefing practices in general (Hassanen and Bouchlaghem, 1999) and within the industrial partners in particular (Hassanen and Bouchlaghem, 2000) has been conducted. The latter has revealed the following main characteristics of the briefing process;
- Briefing involves a huge and wide range of initial/preliminary but crucial information/data from different independent sources.
- Briefing involves concurrent and collaborative work by different non co-located parties over the same information.
- Some of the actors, including clients, involved in the briefing process have little understanding and knowledge about buildings.
- All possible options should be comprehensively examined at this stage to ensure that no potential alternatives have been missed. However, and due to the short time allocated for this process, such examinations can not be conducted in depth or in detail.
- Many changes and revisions occur during the briefing stage; critical changes which affect the decision making, should be effectively reflected and notified to all relevant parties.

- Needs of the client have opposite impacts (especially in large projects) on the design attributes. Requirements need to be rated and ranked to identify the most important requirements to be fulfilled (in case of contradictions) and, hence, maximise clients' satisfactions. This is a very complicated task if it is a large project.

The present paper gives a comprehensive overview of the CoBrITe project, including an analysis of the briefing practices and information requirement. The paper also includes a description of the CoBrITe system architecture. The latter proposes a framework that integrates a set of proprietary and commercial software applications aimed at supporting the briefing process.

CURRENT BRIEFING PRACTICES IN THE UK CONSTRUCTION INDUSTRY

The commercial partners involved in the CoBrITe project have all implemented proprietary solutions to address the problems associated with the briefing process. Information technology is used extensively to represent information, with the "de facto" standard tools being Microsoft Office (Word processing, Excel spreadsheet, Access database, PowerPoint presentation software). In most cases this information, once captured and represented, is stored in a shared network directory. Although the use of document management systems for managing this electronic information is limited, several organisations are conducting trials to evaluate this type of technology. In addition, most partners make use of visualisation techniques. These range from presenting information in a schematic rather than tabular manner through 2D and 3D visualisation techniques and visual walkthroughs. Relational databases are also used to hold generic or common data. Project-specific information are then generated from these databases and conveyed into different forms, including room data sheets. This information can be reused in subsequent projects.

Due to legal and business considerations, none of the CoBrITe industrial partners use electronic media as their primary mechanism to distribute documents to other partners on projects, although awareness of the technology is overall fairly good. Despite the availability in electronic form of most information used and produced during the briefing process, paper-based information remains the principal foundation for communication. Organisations do use email to distribute information to other entities with whom they collaborate, for example in a partnering relationship, but hard copy information is still provided. It is also worth noting that electronic information is produced from a variety of de facto formats.

Furthermore, the CoBrITe partners have not yet adopted the modus-operandi of the so called "virtual enterprise" where most information is created, shared, and exchanged electronically. The face-to-face meeting is considered as an essential part of the brainstorming and requirement capture process. Several partners either use, or are considering using, proforma (either paper-based or electronic) in order to ensure that relevant information is captured for any stage of the process. These are based either on textual documents or on database technology. Also, the organisations involved in the project, with one exception, do not have a thorough recorded map of the processes involved in briefing, but these are, however, well understood on an individual basis. A document describing briefing and what is required from the brief exists in several cases, although these documents do not contain a comprehensive record of the briefing processes. This document is often out of date or obsolete, or not relevant to the organisation at the current time (i.e. is not used). It is worth mentioning that BAA believe that a good understanding of their business processes will produce efficiency

gains in the briefing process. They are currently implementing IT based solutions to achieve their process driven approach to managing the brief.

It was also noted that most CoBrITe partners recognise the potential usefulness of building a corporate knowledge base but feel that the cost and complexity of implementing such a system would negate any benefit in the short term. There is a common feeling that current available commercial offers are not mature and reliable enough to undergo large scale implementation. Several organisations do, however, acknowledge the potential usefulness and expressiveness that this kind of technology would provide in the representation of information and in the communication of ideas or concepts.

PROPOSED ICT IMPROVEMENTS TO THE BRIEFING PROCESS

Five areas of technological relevance, which may impact on briefing efficiency, have been identified within the CoBrITe project. These are *communication*, *information capture*, *information representation*, *change management*, and *information referencing* (see Figure 2). In addition, five general key areas for better briefing have also been identified in (Barrett and Stanley, 1999).

Key Area 1: Communication

Communication is the process by which information is exchanged between two entities. In most cases this will involve two identifiable individuals, but it also includes information exchange between individuals and organisations, or between two organisations. Communication issues in the briefing process impact on all other areas in the process. Information exchange in the briefing process is performed using several mechanisms; the most popular of these is the meeting, where individuals exchange information in a face-to-face manner. Other exchanges are performed through electronic media (email) or by exchanging hard copy information.

There are a number of requirements that any information technology solution supporting information sharing and exchange must fulfil. The process must be secure, it must conform to the ideals of non-repudiation (when a courier collects a document there is a written record of its collection and likewise for its delivery, and the same is expected for electronic information exchange). Additionally, the process should ensure that information is captured effectively. These communication mechanisms are well established as manual processes; there are several technologies available that would allow this communication to occur and its requirements to be met electronically. IT tools to assist the communication processes include: Email, Encryption, digital signatures, groupware solutions, document management systems, and workflow solutions. Other tools that may help communicate ideas, rather than hard information, include those related to visualisation.

Key Areas 2 and 3: Information Capture and Representation

The communication process is concerned with the exchange of information; this information must be captured and represented in order for it to be analysed and processed for the benefit of an organisation or a project. Information that has been captured and represented must be approved in some manner so that any errors can be corrected and misconceptions avoided, although this is likely to be classified as information management.

The mechanisms used for information capture in the briefing process are largely dependent on the processes undertaken to communicate that information. In meetings or face-to-face exchanges, the information is captured in the memories of the individuals present at the meeting. These memories may be assisted by minutes from the meeting, and occasionally a full typescript of comments made during the meeting will be produced. Note that legal cases are normally fully transcribed for completeness of the records, which may be an indication of how information could be captured for the briefing process. However, even a full typescript will result in the loss of some information, for example gestures or body language will not be recorded. Often visual cues will be used to illustrate points made at meetings, for example, picture boards or 3D drawings of existing buildings, and the inclusion of these in a project's information store so that comments made can be compared to the visual cue that triggered the comment should be considered.

The information capture process is more straightforward if the communication process consists of the exchange of documents or other paper and electronic information since the information is effectively captured and represented as an inherent part of the communication mechanism. Proforma can be used to help ensure that captured information is complete; these are not solutions in themselves, but act as an aide to the process. The capture of information and the representation of that information has been embodied in manual processes with differing degrees of success (depending on the capture and representation processes or methods used) for as long as humans have been communicating. Several technologies are now available that could improve these fundamental processes, many of which are already used by the commercial partners involved in the CoBrITe project.

Any technological solution or improvement to the information capture and representation processes must be able to record information in a manner that is understandable, i.e. as a written document or some other familiar structure that professionals can make use of. It must be accurate, so the information captured and represented reflects the information exchanged and precise, so that as much information exchanged as possible should be captured and represented. Tools that represent information should be easy to use (or they will not be used). As part of this ease of use, tools should be well integrated to avoid unnecessary duplication of information; related information is often formatted in different ways, but all information should be available regardless of its file format.

Information technology tools to assist in the representation of information are numerous, and widely used within organisations. These include word processors, spreadsheets, databases, and CAD. Mechanisms can be employed to record (capture) non-electronic information in an electronic form, such as scanning of sketches or hard copy documents. This information can then be stored on CD or DVD, and software exists which will take scanned documents and convert them to textual electronic data rather than as an image. The current voice recognition systems are likely to soon be able to produce typescripts from meetings. Other tools that help in the information capture process include data warehouses (new information and trends may be able to be extrapolated from existing legacy data), email (messages sent form a "permanent" record of information exchanged, therefore capturing that information automatically) and GroupWare. Once this information has been represented it may be linked using some referencing mechanism to allow the semantics of a project, which may span several information sources, to be followed.

Key Area 4: Information Referencing

All projects generate and use information; the complexity of the project will often dictate the amount of information captured, stored and managed. A large construction project can generate a massive amount of information that no individual can hope to assess and understand in its entirety. In order to help ensure that relevant information is not overlooked during the decision making process, this stored information should be referenced in some manner. Information is indexed by organisations so that the individual following the retrieval process can retrieve any required data with the minimum of effort. Like other processes in the general information management cycle, the reference and indexing of paper based records is well understood. People have been managing huge amounts of information using manual mechanisms for centuries (for example, cataloguing information held in a library), and if these manual procedures are followed rigorously they work well. It is however a hugely complicated task to cross reference this information and to check that all references to the information or from the information are correct and it is this process that allows errors and omissions to be made. Effective referencing of information can also help ensure that all the required information has been captured and that the required information has not been captured in multiple, contradictory documents.

Technological solutions to this cataloguing and referencing of information are an obvious application of information technology, which can iteratively process and index massive amounts of electronic information quickly and without error. Whether this technology would be useful in the context of the briefing process or not depends largely on the effectiveness of existing manual indexing and cataloguing mechanisms and on the amount of information that must be managed. Information technology for information referencing can be separated into several areas: tools that maintain references between documents, like a library catalogue; tools that create indexes of information; tools that can search these indexes and generate lists of appropriate information related to a search term or terms; and tools that allow sections of documents to be referenced.

Often this last category of tool (tools that allow sections of documents to be referenced) consists of the tools used to represent information, such as a word processor or CAD package. The Microsoft Office suite of applications performs this task adequately. Unfortunately these tools normally support referencing in a proprietary way, so references to document sections may not be available outside the tool the information was generated in. IT tools assisting the information referencing processes include: Index Servers, Hard copy to electronic copy conversion tools (OCR, Adobe Acrobat, etc.), Tools that represent information (such as Word Processors), Web technology (hyperlinking in HTML information).

Key Area 5: Information and change management

Information is not a static resource. As projects progress change to the stored information base that has been built up during the project are inevitable. Often these changes will themselves need to be recorded as new information for the project knowledge base. Sometimes *why* information has been changed is as important as the change itself. Projects that wish to record the reasons for change are likely to do so by adding a new piece of information into the project knowledge store, by perhaps updating a change log for a specific item of information. These manual procedures are again well understood and effective for hard copy if performed consistently within a project. Changes to information can often cause side effects; changes may affect related information and perhaps cause a cascade of changes

within the collection of stored knowledge to become necessary. The manual process for updating related information could be very time consuming in a project with a large store of knowledge. Technological approaches to performing this operation are unlikely to be possible to implement if the cascade is to be done automatically; however, technology can help to identify changed information, the reasons for changes, and any related information that may be affected by a change. As an aide to the manual process information technology may help to ensure consideration of all related information. Information, once created and stored, must be managed. It must be possible for personnel to access any information they need, and for authorised personnel to modify the information. Perhaps more importantly, information that should not be modified, or that should only be modified by a limited number of individuals, should be protected from unauthorised updates. In many cases organisations will wish to manage their stored information in a way that closely resembles their existing manual processes.

Any technological solution to assist with information management and change management needs to consider the security of information, "audit-ability" of changes and versioning of information to prevent loss of data. It is likely that this area of information technology will be very relevant to the briefing process. The technological areas addressing these problems include: document management systems, groupware systems, and workflow systems. The efficiency of an organisation's existing manual processes in the process of change and information management should not be underestimated or ignored. It may be that a technological solution that mirrors existing (manual) processes is the optimum solution for an organisation.

COBRITE PROPOSED PROOF OF CONCEPT DEMONSTRATOR

Following the above requirements and the review of the industrial partners briefing practices, as well as their current technology implementations, a web-based solution built around a shared workspace has been proposed. The latter makes use of BSCW for storing and archiving information. The shared workspace holds all information concerning the brief as well as its evolution. It is structured according to the four topics resulting from the analysis of the characteristics of briefing (as illustrated in Figure 1), namely: Communication, Folders, Process, and Legacy. The CoBrITe demonstrator authenticates users during the logon procedure. Users are then prompted with a list of projects to which they have authorized access. Users are then given access to a project shared workspace upon selection of a specific project. The CoBrITe demonstrator presented in the paper made use of the Wythenshaw Hospital project, provided by WS Atkins.

The Communication panel provides access to the details of any actor involved in the briefing process, and provides ways of communicating with the actors, mainly via e-mail or fax. The Folder panel provides a structured access to project information. The stored information include bitmap images (representing the planned building), text documents, CAD drawings, detailed spreadsheets, and structured data stored in relational databases. The legacy panel provides structured access to corporate legacy information organized on a project-basis. Users can perform a search against a set of defined criteria, as illustrated in Figure 1.
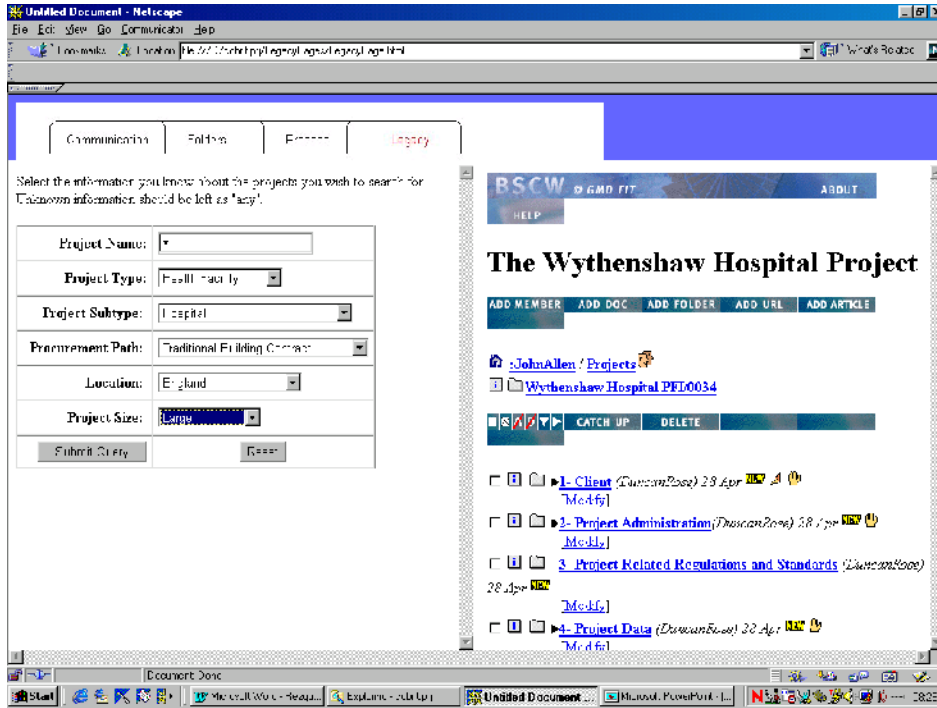
Fig. 1. The CoBrITe shared workspace.

The Process panel provides a process driven representation of the briefing lifecycle. The RIBA plan of work has been implemented for the purpose of the demonstrator. This panel provides also a process driven access to information. The IDEF0 methodology has been used to map the briefing process. Users can access information used as a control, mechanism, input or output to each briefing activity, as illustrated in Figure 2.
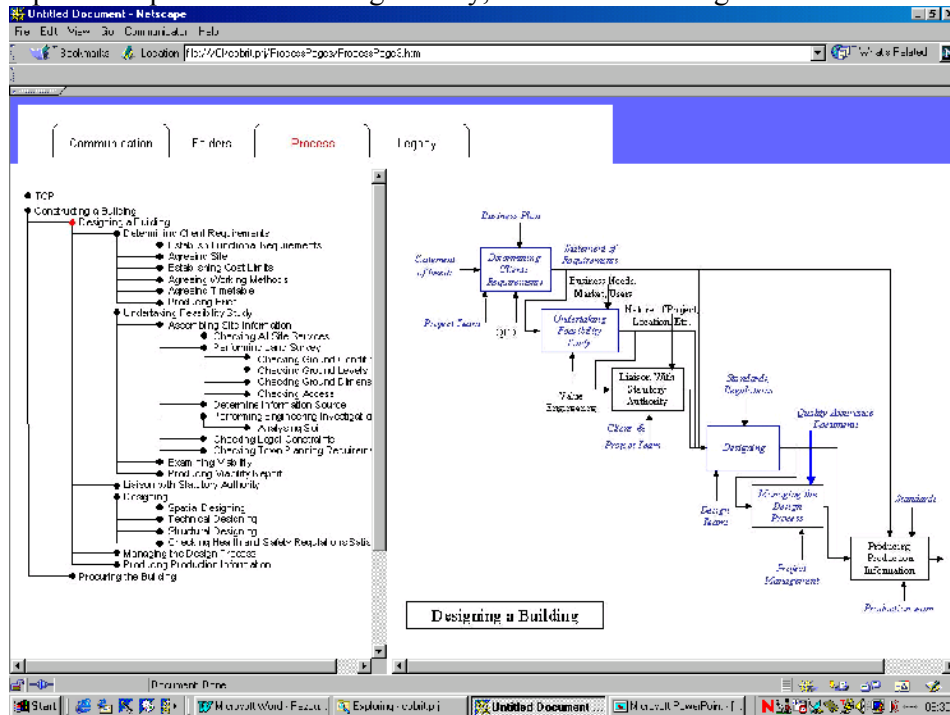

Fig. 2. The CoBrITe Process Oriented View.

COBRITE NEW PROTOTYPE

Based on the consortium wide evaluation of the CoBrITe demonstrator presented in the previous section, a new prototype has been developed.
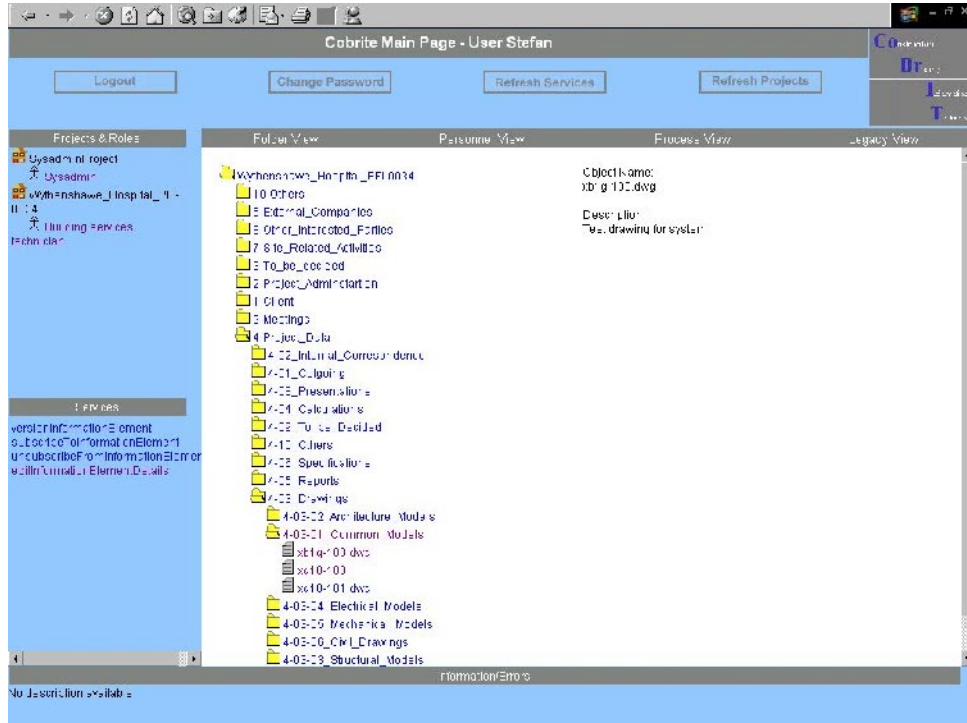
Fig. 3. The CoBrITe Information Browser View.

This new prototype is completely autonomous as it doesn't build on the BSCW document server. It has been developed using open source technology (Java – APACHE web server). The panel on Figure 3 gives access to users to all project information. Users act on the documents according to the rights conferred to their role. This is set-up by the CoBrITe system administrator through a project management interface, as indicated in Figure 4.

Fig. 4. The CoBrITe Access Right Control View.

CONCLUSIONS

The paper presented a comprehensive overview of the work undertaken in the CoBrITe project. The main characteristics of the briefing process were discussed in the light of the current practice review with the industry collaborators. Five proposed key areas for technological improvement, with regard to IT implementation, are briefly covered. The CoBrITe demonstrator has been described. The latter provides a structured access to legacy as well as ongoing projects information and knowledge.

A new autonomous prototype implemented using the JAVA technology has been developed. This is now in the process of being deployed within WS Atkins on the Wythenshaw Hospital project.

ACKNOWLEDGEMENT

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