IT TOOLS AND SUPPORT FOR IMPROVED BRIEFING

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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 architecture is presented. The project is ongoing and supported by the Link / IDAC program.

KEYWORDS: Information Technology, Client, Construction, Briefing.

1. INTRODUCTION

The briefing stage is critical to the success of construction projects, but it is widely recognised that improvements are needed in this process in order to reduce the cost and optimise quality of buildings (Latham, 1994). The briefing process involves understanding the client's needs and expressing them in a way that will ensure compatibility between the client's vision of the project and the resulting product.

There are problems encountered in construction briefing which involve both clients and designers. 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. This aim translates into the following objectives:

[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)

- highlight shortfalls and best practice by reviewing information management techniques and the use of IT during briefing;
- integrate recent/current research projects concerned with briefing and form a research network;
- access potential users' needs in terms of use and diversity in both small-medium and large projects, focusing on the five key improvement areas (Link IDAC 88);
- identify promising systems/products that could assist the Key Improvement Areas by conduct an audit of existing enabling information technologies (including interfaces);
- position the IT products within the framework of briefing and design processes in Level 2 of the IMI Process Protocol and the IAI Business Process Model, to inform their development;
- identify specific IT tools and methods for the five improvement areas;
- produce a prototype integration environment for the management of briefing and design information;
- deploy effectively the proposed approach by re-engineering the briefing process redesign (within the industrial companies involved in the consortium).

The project builds on the recent IDAC 88 project (Barrett and Stanley, 1999): Managing the Brief as a Process of Innovation, and its five key action areas for improvement: empowering the client, managing the project dynamics, appropriate team building, appropriate visualisation techniques, and appropriate user involvement. It is driven by the needs of solving challenges within the briefing and related design process, with IT a means to an end.

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.

2. THE BRIEFING PROCESS

2.1 Definition of the briefing process

There are many different definitions for the briefing process within the construction industry and amongst researchers and professionals working in this field (BSRIA 1990, CIB 1997, BRE 1987, BS-7832 1995, and CIRIA 1995). Briefing involves different activities and processes to different people. One of the aims of the CoBrITe project is to define the briefing process in order to deploy the appropriate IT tools to improve and support briefing. Within a comprehensive data gathering, as it will be presented later, the seven industry partners were asked to define the briefing process from their points of view.

Although most of the industry professionals agree that the RIBA Plan of Work (RIBA, 1967) represents the most practical model for average size construction projects, it is interesting to point out that the different professionals can not reach an agreed definition for the briefing process. Briefing meaning is often dependent on discipline, project or whether the person is a consultant or a client.

The disagreement may be explained by the diversity of the industry discipline, activities, projects, and interests. 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 organisation 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 suggested definition assumes that the process is continuing until the client's requirements are translated into effect (i.e. the final building) which suggests that the briefing process is extended to the end of construction stage. This definition is welcomed and supported by professionals representing clients' organisations.

The situation for the consultants is quite different. The consultant's main interest is to define the project stages as clearly as possible to avoid any conflicts with the client. This has the advantage of getting the requirements of the clients at a relatively early stage and allows proceeding to the next stages with confidence in the data/information gathered. Also, early concluding of the briefing stage enables the consultants to charge the client for any extra work occurs due to change in requirements/needs or scope by the client.

It is, then, agreed, within the current project, to define the process to be "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). With this broad definition, IT tools would have more role to support the process. The progress of the process has to reflect the granularity of the associated decisions. Decision about elements of certain requirements has to be fixed at certain points while other would be floated till later stages of the process. This needs great understanding for the systems interdependency to enable last responsible moment tactic to be applied.

2.2 Characteristics of the briefing process

From an extensive literature review and the review (Hassanen and Bouchlaghem, 1999) of the work practice with the industry partners (Hassanen and Bouchlaghem, 2000) the main characteristics of the briefing process, with regard to the information technology tools, may be identified and highlighted as follows;

- Enormous amount of initial/preliminary but crucial information/data from different independent sources. However, the information is not considered as final and subject to revisions and amendment.
- In many situations, different parties are working simultaneously on the same piece of information.
- Participants of the briefing process (i.e. client/user/brief-taker) are, in general, experts in their own specialists but not experts in all fields related to the project and in many cases have to make decisions in areas out of their speciality.
- Some parties of the briefing process are neither familiar with engineering or construction terms nor able to read engineering drawings and they need supporting aids to convey and clarify the technical terms.

- 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 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 monitored to all relevant parties.
- Unlike the design stage where most of the design teams are located closely within the same geographical zone, the different parties involved in the briefing process are geographically apart or located in different organisations.
- Regarding cost and work programme, the briefing stage is a very critical stage – most decisions affect the total cost of the project and the work programme – any decision has to be properly monitored and traced.
- Very short time is, generally, allocated to the briefing process and the time to examine details is very tight - previous experiences support and aid to avoid repeating work
- 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.

3. CURRENT TECHNOLOGICAL IMPLEMENTATION BY COBRITE PARTNERS

The commercial partners involved in the CoBrITe project have all implemented technical solutions of one form or another, and of varying levels of complexity, to address problems associated with the briefing process. The commonalties between the commercial partner's implementations should be highlighted as these provide the foundation of the technological proposals that may be made by the academic team. Areas of technology implemented by one partner but not others will be highlighted since these may show an application for IT in best practice not so far considered by the majority of partners. All partners have invested in IT solutions across many areas in their organisations. Each organisation has an internal network, potentially allowing internal exchange of information to be conducted efficiently but many do not have full Internet access which may restrict the capability to exchange information between co-operating organisations, for example in a consultant - client relationship.

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 represented, can be stored in a network directory to reduce the likelihood of information loss if the failure of an individual PC occurs. Although the use of document management systems for managing this electronic information is limited, several organisations are conducting trials to evaluate this kind of tool.

All 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 organisations use electronic media as their primary mechanism to distribute documents to other organisations, although awareness

of the technology is good. Hard copy information remains the foundation of communication and very often electronic versions are distributed simultaneously with the hard copy, although it is the hard copy information that is expected to be retained and stored rather than the electronic information. Organisations use email to distribute information to other entities with whom they work closely, for example in a partnering relationship, but hard copy information is still provided in addition and is used as a record of information provided.

Currently the partners do not expect to form what may be termed "virtual collaborations" where all information and communication is created and exchanged electronically. The face to face meeting is considered an essential part of the process of idea exchange. Several partners either use, or are considering using, proforma (either paper based or electronic) in order to ensure all relevant information is captured for any stage of the process. These are based either on textual documents or on database technology.

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 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). BAA believe that understanding the business processes will produce efficiency gains in the briefing process and are implementing information technology solutions to help with this goal.

Most organisations recognise the potential usefulness of building an organisational knowledge base but feel the cost and complexity of doing so would negate any benefit in the short term. There is a common impression that information technology has to develop further before this kind of solution will be able to be implemented in a commercial setting.

The lack of interoperability between applications throughout an organisation is considered to be a problem. Several organisations are hopeful regarding the extra power of expressiveness this integration would provide in the representation of information and in the communication of ideas or concepts.

Most of the CoBrITe partners do not consider the file format of the information created; the important result in using any information technology tool is the hard copy produced, so the use of proprietary rather than open file formats is commonplace. Although this does not necessarily prevent solutions from being implemented it will often reduce the choice of applications available to address a particular problem. It also makes the task of creating bespoke solutions if necessary more complex than it might otherwise be.

4. PROPOSED FIVE KEY AREAS FOR TECHNOLOGICAL IMPROVEMENT THROUGH IT SOLUTIONS

Five areas of technological relevance have been identified which may impact on briefing efficiency. The relationship between these five areas and the five areas can be found in (Barrett and Stanley, 1999).

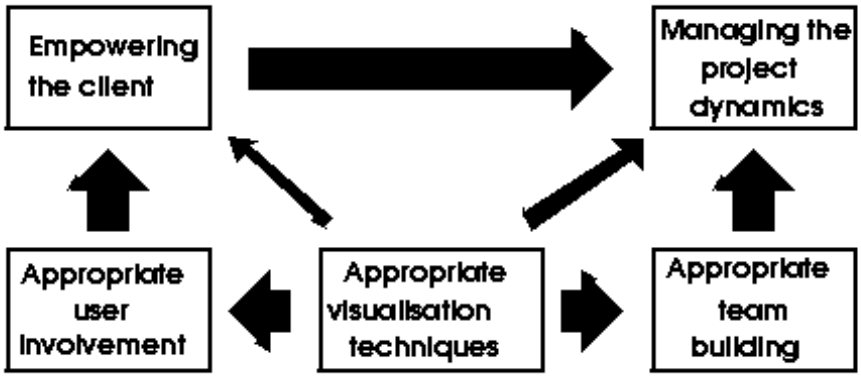

Fig. 1. Major Solution Areas and three supporting issues.

The five key areas for technological improvement were *communication*, *information capture*, *information representation*, *information and change management*, and *information referencing* (see Figure 2).

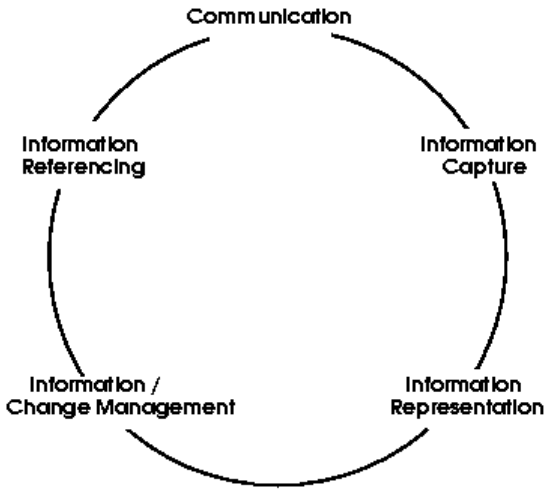

Fig. 2. Five IT areas for improved briefing (CoBrITe)

4.1 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.

However information is exchanged, there are a number of requirements that any information technology solution for doing so 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 of electronic information exchange). Additionally, the process should assist information to be 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.

4.2 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 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.

4.3 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).

4.4 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 store. 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 are 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 efficacy 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.

5. COBRITE PROPOSED SOLUTION

To identify and deploy the appropriate IT tools required to support and improve the practice of the briefing process; the aforementioned characteristics of the briefing process have to be considered. Careful study of the above characteristics suggests the following criteria for the tools required:

- Tools should be able to increase and improve communication between parties in different organisations and/or different geographical regions in order to bring them together and remove the difficulties associated with communications such as time and efforts. It should reduce the dependency on papers and make communications much easier specially when physical distances exist and when longer time is consumed in communications.
- It should be able to simplify and explain complicated drawings/diagrams and very technical terms to simple 3-D models/images or pictures/photos to improve and ensure understanding of options/alternatives by parties who have no or little engineering backgrounds.
- It should be able to effectively utilise the accumulated previous experiences and knowledge related to the project to be accessed, searched, recalled and deployed at the relevant situations. Moreover, it is preferred to be flexible for upgrading and building on the existing experiences/knowledge for future use.
- It should allow easy access to the information/knowledge in the public (or other) domains related to the project especially with such information that is changed frequently and that might affect the project (e.g. standards, codes of practice, regulations, etc.).
- It should allow the users to share the same piece of information simultaneously to avoid users keeping their own copy of it with the associated problems of using outdated information. It should allow information to be expressed in a neutral language, which can be dealt with by different application to allow automated sharing of information by different applications.
- It should be allow comprehensive consideration for the entire client needs and allow specifying the interrelation between each requirement and all other requirements.
- The above requirements are the basic criteria for the IT tools that will be considered in choosing the appropriate ones for trial and evaluation in the next stage.

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 is being proposed (Fig. 3). The shared workspace will hold all information concerning the brief as well as its evolution. The stored information include bitmap images (representing the planned building), text documents, CAD drawings, detailed spreadsheets, and structured data stored in relational databases.

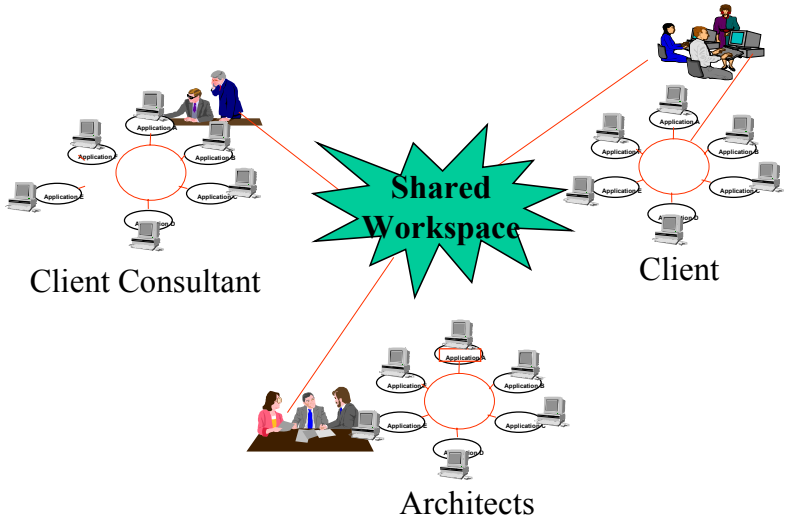

Fig. 3. The CoBrITe shared workspace.

The system architecture supporting the shared workspace is illustrated in figure 4. The components of the architecture include an API dedicated to briefing along with a set of tools used to browse, visualise and retrieve information.

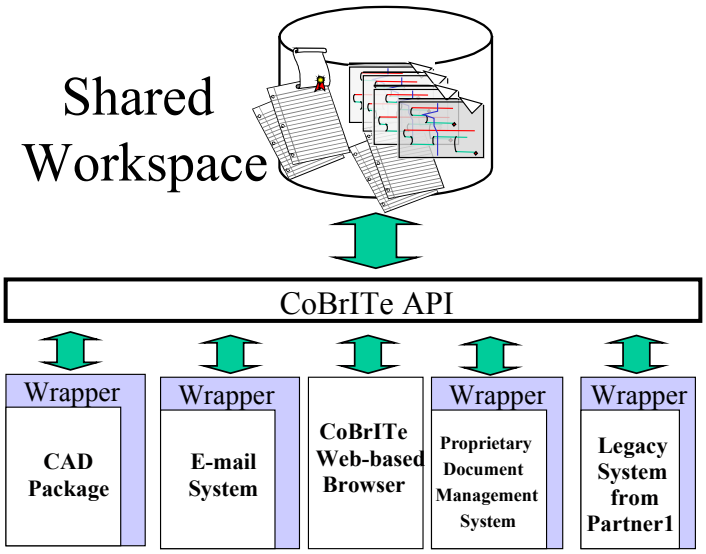

Fig. 4. The CoBrITe system Architecture.

6. CONCLUSIONS

The paper presented a comprehensive overview of the work undertaken in the CoBrITe project. Different definitions for the briefing process including the one adopted in the CoBrITe project were given. The main characteristics of the briefing process were discussed in the light of the current practice review with the industry collaborators. Also, the current technological implementation by the project partners were summarised representing the general practice within the construction sector. Five proposed key areas for technological improvement, with regard to IT implementation, are briefly covered. Based on the characteristics of the briefing process, the current technological implementation and the proposed areas of improvements, a solution is proposed to utilise IT to support the briefing process.

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