An IT-based approach to managing the construction brief

Yacine Rezgui[1], Dino Bouchlaghem[2] and Simon Austin[2]

ABSTRACT | The present paper gives a comprehensive overview of the CoBrITe[3] project. The aims and objectives of the project are described, followed by a detailed definition and characterization of the briefing process. An overview is then given of the current technology used by the CoBrITe industrial partners to support briefing. 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.

KEYWORDS | information technology, client, construction, briefing.

1 Introduction

Briefing in construction has become the focus of considerable attention in the post-Latham era, both within the research community and amongst industry professionals. The Latham report [1] identified briefing as one of the key areas where improvement is needed in order to reduce construction costs and increase client's satisfaction. It is therefore widely agreed that a closer look at the process of briefing is needed in order to identify where improvements are required.

One of the key issues in briefing is to identify the function it should fulfill and decide where it fits into the construction process. Jenks [2] asked the following questions: 'Is the briefing process the starting point of a design? Is it a process that matches the design step by step? Or is it merely a process for receiving the clients instruction?' The current debate on briefing is whether the brief should be completed before the design starts or whether a more interactive process is beneficial.

A review of construction briefing [1] identified key areas which most impact on its quality: the process and the participants, management of the process, format and content of the brief, clients' role and support during the process. The report also attributes poor briefs to inadequate briefing, where this has been taken to mean that there is a lack of detail and clarity. Apart from a recommendation to clients to sign off the brief as part of the contractual process, the result of Latham's interest in the topic was the establishment of a working group to produce a checklist guide for the process. However, this is not a new approach, as a number of lists are already available from organisations such the Royal Institute of British Architects [3], the Building Research Establishment [4], Construction Industry Research and Information Association [5] and even the BS 7832 [6].

The argument behind using established standard [7, 8, 4, 6, and 5] methods and checklists is that high standards can be easier to maintain. However, the building sector is

1. Information Systems Institute, University of Salford, The Crescent, M5 4WT, Salford/Manchester, UK, Y.Rezgui@salford.ac.uk
2. Department of Civil & Building, Engineering, Loughborough University, Leicestershire, LE11 3TU, U.K., N.M.Bouchlaghem@lboro.ac.uk
3. CoBrITe is a research project funded by the Link / IDAC program involving two academic institutions (Loughborough and Salford Universities) and seven industrial partners (AMEC, BAA, Boots, BDP, Nuffield Hospitals and WS Atkins)

quite complex, and methods for standardising the brief are generally met with resistance. Newman *et al.* [9] found that 80% of private architects and 50% of local authority architects have no formal briefing procedures, but conduct briefing for each project as seems appropriate. The same research revealed that many of the clients and architects who had tried to use checklists found them difficult to relate to the real world. Clearly, what is required is evidence of whether standard methodologies, checklists, and signing off procedures do have any effect on the quality of briefing.

A variety of definitions of briefing can be found in [7, 8, 4, 6, and 5]. Consultants tend to consider briefing as a limited process with a well-defined start and end, with records of subsequent changes to support fee claim for extra work. On the other hand, clients consider the briefing process to extend until almost the final stage of construction to ensure that the final product meets their requirements and fulfils their objectives.

The definition of briefing adopted 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 briefing and delineates the 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 [10].

Responsibility for the brief is usually shared between the client (and client's advisor) and the briefing consultant, as suggested by the code of practice for project management [11] which divides the brief into three steps: outline project brief, detailed project brief and detailed design brief. The client is responsible for the first of these while the briefing consultant and designers share the responsibility with the client for the other two.

It is well known in the industry that a number of problems are encountered during the briefing stage of a construction project: there is little guidance and support for clients; designers have difficulties in capturing clients' needs and conveying conceptual design options to them; and there is a central difficulty associated with language, communication and exchange of information between clients and design teams.

The CoBrITe project team 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 more established. Early stages of the research also revealed that there is no agreed process for briefing activities. Thus 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 paper gives an overview of the CoBrITe project, including an analysis of briefing practices and information requirement. The paper also presents a description of the proposed CoBrITe system architecture, which supports a set of proprietary and commercial software applications aimed at supporting the briefing process within an integrating software environment.

2 Current Practices and Criteria for ICT Support

2.1 Briefing

A review of briefing practices within the industrial partners involved in the CoBrITe project revealed the following characteristics [12]:

- Briefing is conducted through a number of well-defined and interrelated activities.
- Briefing involves the handling of large amounts of information critical to the project's lifecycle.

- Information is usually processed by a number of participants during the process.
- Briefing involves concurrent and collaborative working between a number of distributed organisations.
- Some of the key participants in the briefing process have little understanding and knowledge about buildings and the construction industry.
- Little time is usually allocated to the process.
- Some of the clients' requirements can be conflicting, hence prioritising these requirements can be critical in ensuring clients' satisfactions.

These initial findings reinforced the project's main aim, that a closer look at briefing is required in order to improve the process especially with regard to ICT support.

2.2 ICT Support

All the industry partners involved in the research have implemented proprietary solutions to address the problems associated with the briefing process. Information technology is used to process 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 manner through to 2D and 3D models and walkthroughs. Generic or common data is held in databases and project-specific information is then generated from these databases in a variety of forms, such as room data sheets. This information can provide feedback to subsequent projects.

Due to legal and business considerations, the CoBrITe industrial organisations avoid electronic distribution of documents to project partners, although awareness of the technology is fairly good. Despite the availability in electronic form of most information used and produced during briefing, most paper information is exchanged in paper media. Organisations do exchange information by email, but hard copy is still provided. It is also worth noting that electronic information is produced from a variety of de facto formats.

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 essential for the brainstorming and capture of requirements. Several partners either use, or are considering using, Proforma to ensure that relevant information is captured at specific stages of the process. These are either text documents or a database technology.

Only one of the organisations involved in the project have a 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 and can be out of date or obsolete.

Most CoBrITe partners recognise the potential of a corporate knowledgebase in the representation of information and in the communication of ideas or concepts, however, they 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 proprietary software is not mature or reliable enough to undergo large scale implementation.

2.3 Criteria for Improved IT Support

The above characteristics of the briefing process and state of ICT support were investigated to help appropriate IT tools and systems that may improve the practice of briefing. Study of these characteristics suggests the following criteria for the tools required, these should:

- improve communication between parties in different organisations,
- facilitate the interpretation and understanding of some types of information, such as drawing, by non-technical participants,
- enable access to historic information from past projects,
- allow easy access to the information in the public domains (e.g. standards, codes of practice, regulations, etc.),
- facilitate concurrent working and sharing of information,
- help structure briefing activities into a generic process.

3 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*. These can be compared with five general key areas for better briefing identified by Barrett and Stanley [13].

3.1 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 teams, or between two organisations. Effective communication is clearly central to good briefing, as the conduit for the exchange of needs and solutions. Information is exchanged by a variety of mechanisms; the most popular being the meeting, where individuals communicate visually and orally. Other traditional methods include paper, telephone and electronic media e.g. fax.

Whilst these communication mechanisms are well established as manual processes, there are technologies available that can improve efficiency and effectiveness. They include: email, project collaboration software, groupware solutions, document management systems, workflow and visualisation tools. The latter can help communicate ideas, rather than hard factual information

There are a number of requirements that any information technology solution supporting information sharing and exchange must fulfil. The process must be secure and 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). This can now be achieved by digital systems and encryption. It should also capture that information effectively.

3.2 Information Capture and Representation

The information exchanged by the communication process must be captured and represented for it to be analysed and processed for the benefit of an organisation or a project. It must then 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 issue).

Information capture during briefing is largely dependent on the communication processes. In meetings or face-to-face exchanges, it involves the memories of the individuals, which may be assisted by minutes and sometimes a full transcript of comments made during the meeting. It is noteworthy that legal cases are normally fully transcribed for completeness of the records, which may be an indication of how information could be captured during briefing. However, even a full transcript 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 can help with

subsequent interpretation of written comments and memories.

Information capture is an inherent part of the communication process if it involves the exchange of documents or other paper and electronic information, and therefore more straightforward. Proforma can help ensure that complete information is captured; these are not solutions in themselves, but act as an aide to the process. A range of 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, eg as a written document or some other familiar structure that professionals can make use of. It must be accurate, reflecting the information exchanged and precise, so that as much information exchanged as possible should be captured and represented. Tools should be easy to use (to encourage uptake) and well integrated to avoid unnecessary duplication of information capture and storage, and to reduce the possibility of conflicting versions of the same data; 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 to support briefing.. They include word processors, spreadsheets, databases, and CAD. It is also common to record non-electronic information in an electronic form by scanning sketches and documents. This information can then be stored on CD or DVD, and converted into textual electronic data by optical character recognition software. Voice recognition systems are continually improving and will soon be able to produce typescripts from meetings. Other tools that help in the information capture process include data warehouses (which can extrapolate new information and trends from existing legacy data), email (messages sent form a permanent record of information exchanged, therefore capturing that information automatically) and GroupWare. Once information has been represented it may be linked using a referencing mechanism to follow the semantics of a project, which may span several information sources.

3.3 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 will generate a massive amount of information that no individual can hope to assess and understand in its entirety. Information should be referenced to help ensure that relevant data is not overlooked during the decision making process . Information is indexed by organisations so that the individual following the retrieval process can access the 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. However, cross-referencing this information is a very complicated and time-consuming process that is prone to errors and omissions. 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 large amounts of electronic information quickly and without error. Whether this technology would be useful in the context of the briefing process depends largely on the effectiveness of existing manual

indexing and cataloguing mechanisms and on the amount of information that must be managed. There are several types of information referencing software, including: 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 can also represent information, such as a word processor or CAD package; for example the Microsoft Office suite of applications performs this task adequately. Unfortunately proprietary tools normally support referencing in a closed system, preventing access from and to external sources. 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).

3.4 Information and Change Management

Information is not a static resource. Changes to the stored information base that has been built up during the project are inevitable as the project progresses. 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 would be very time consuming in a project with a large store of knowledge. Technological approaches to performing this cascade operation automatically maybe impractical to implement ; 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 data they need, and for authorised personnel to modify it. 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, auditability of changes and versioning of information to prevent loss of data. This area of information technology is very relevant to the briefing process. The technological solutions addressing these problems include: document management, groupware 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.

4 The CoBrITe Briefing Process Model

4.1 Format

The CoBrITe Briefing Process Model was developed to respond to the need for improved co-ordination and performance during briefing. More specifically, the

team agreed that a graphical representation of the process would not only help communication and a shared understanding, but also act as a vehicle for capturing, representing and locating information (covering three of the five technology areas). Having established the need to define the core activities of briefing and the flow of information, the IDEF0 [14] representation was adopted to develop the briefing process model. Using this method activities (defined by a verb-noun description) are represented by a series of text boxes connected by four ICOM arrows: Input and Output arrows to represent the flow of information plus Control and Mechanism arrows (the latter typically used to show people and resources required). A model of the briefing process was developed by reference to the documentation obtained from project partners who had some form of standard approach and to the generic design and construction Process Protocol [15] being developed in a parallel research project. The Process Protocol provided a framework of stages and high-level briefing activities in which to locate regular, more detailed tasks. The result was a validated and co-ordinated set of hierarchical diagrams representing over 60 activities split over 4 levels. Table 1 shows the activities that are included in the process model and the work breakdown structure.

The model includes generic templates for documents (of a typical construction project) agreed by the industry practitioners as briefing deliverables, these are supported by software applications and are linked to the activity as input, output or control. Table 2 lists these deliverables with their IDs as they appear on the graphical model alongside the main activities. In the electronic version of the model, each of the deliverables showed on the diagrams representing either an output of a certain activity (horizontal arrow out of the box) or input to another (horizontal arrow into the box) or simply acting as a control document to other activities (downward arrow) is linked to the relevant electronic file that resides in a unique location within a structured system of project folders. Each document is in turn linked to other related documents (if applicable) to allow automatic update should any of these documents be edited. Furthermore, the 'mechanisms' in the model (i.e. upward arrows) are also linked to the relevant applications (or the standard document template, if applicable) to provide access to information processed by the activities.

The parties who are involved in carrying out an activity are shown on the lower left corner of the box. The character "C" refers to the Client team while "D" refers to the Design team and "C-D" means that this activity is to be conducted by the Client and/or Design teams (Figure 1).

4.2 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 was proposed, built around a shared workspace. The latter makes use of BSCW [16] 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 2), namely: Communication, Folders, Process, and Legacy. The CoBrITe – V0 demonstrator authenticates users during the logon procedure. Users are then prompted with a list of projects to which they have authorized access. They are then given access to a project shared workspace upon selection of a specific project. The CoBrITe – V0 demonstrator presented in the paper was built on to represent 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 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 includes bitmap images (representing the

Table 1. Activities of the CoBrITe Briefing Process

A0: Design & Construct a Building		
A1: Check the Needs and the Feasibility of Options	A11: Demonstrate the Need	Establish the Need
		Establish (initial) Communication Strategy
		Develop (initial) Stakeholder List
		Prepare Initial Outline Business Case
	A12: Prepare Conception of Need	Prepare Project Brief (initial)
		Assess Stakeholder Impact & Requirements
		Outline Business Case (update)
		Prepare Feasibility Design Brief
	A13: Examine Feasibility	Undertake Outline Feasibility Study for Each Option
		Update Project Brief
		Update Outline Business Case
	A14: Study the Best Option	Refine Outline Business Case
		Undertake Substantive Feasibility Studies on the Most 'Feasible' Option
		Assess Stakeholder Impact & Requirements
		Revise Project Brief
		Prepare Procurement Plan Issues Report
		Prepare Concept Design Brief
		Revise Site & Environmental
A2: Study & Develop the Best Solution to Satisfy the Needs	A21: Study Solutions for the Best Option	Revise Full Business Case
		Update Procurement Plan
		Update Site & Environmental Issues Report
		Prepare Initial Cost Plan
		Revise Project Brief
		Prepare Outline Concept Design
	A22: Develop the Chosen Solution	Revise Full Business Case
		Update Project Brief
		Prepare Full Concept Design P5.7 Update Procurement Plan
		Update Cost Plan
		Update Site & Environmental Issues report
		Prepare Operation policy & Maintenance Plan
A3: Design		Verify Requirements
		Update Project Brief
		Finalise Full Business Case
		Produce Detailed Design
		Update Procurement Plan
		Update Site & Environmental Issues report
		Update Operation policy & Maintenance Plan
A4: Realise the Project	A41: Prepare Production Information	Revise Requirements
		Finalise Project Brief
		Prepare Production Information
		Update Procurement Plan
		Finalise Cost Plan
		Finalise Site & Environmental Issues Report
		Update Operation policy & Maintenance Plan
	A42: Construct	Prepare & Implement Handover Plan
		Manage & Undertake Construction Activities in Accordance with Production
		Develop Operational Product Model
		Revise & Implement Operation policy & Maintenance Plan
A5: Hand-over	Undertake Post Project Review to Examine Client Satisfaction	

Table 2. Deliverable of the CoBrITe Briefing Process Model

Activity	Output ID	Output Document
A11: Demonstrate the Need	O1	Initial Communication Strategy
	O2.1	Initial Statement of Need
	O2.2	Outline Business Case
	O2.3	Initial Stakeholder List
A12: Prepare Conception of Need	O3	Updated Stakeholder List
	O4.1	Updated Business Case
	O4.2	Initial Project Brief
	O4.3	Finalised Statement of Need
	O4.4	Feasibility Design Brief
	O4.5	Initial Site & Environmental Report
A13: Examine Feasibility	O5	Updated Business Case
	O6.1	Updated Project Brief
	O6.2	Outline Feasibility Studies
	O6.3	Updated Site & Environmental Report
A14: Study the Best Option	O7	Refined Business Case
	O8.1	Updated Project Brief
	O8.2	Concept Design Brief
	O8.3	Substantive Feasibility Studies
	O8.4	Revised Site & Environmental Report
	O8.5	Initial Procurement Plan
	O8.6	Updated Stakeholder List
A21: Study Solutions for the Best Option	O9	Revised Business Case
	O10.1	Revised Project Brief
	O10.2	Outline Concept Design
	O10.3	Initial Cost Plan
	O10.4	Updated Site & Environmental Report
	O10.5	Updated Procurement Plan
A22: Develop the Chosen Solution	O11	Revised Full Business Case
	O12.1	Updated Project Brief
	O12.2	Full Concept Design
	O12.3	Updated Cost Plan
	O12.4	Updated Site & Environmental Report
	O12.5	Updated Procurement Plan
	O12.6	Initial Maintenance Plan
A3: Design	O13	Revised Business Case
	O14.1	Updated Project Brief
	O14.2	Detailed Design
	O14.3	Updated Cost Plan
	O14.4	Updated Site & Environmental Report
	O14.5	Updated Procurement Plan
	O14.6	Updated Maintenance Plan
	O14.7	Verified Requirements
A41: Prepare Production Information	O15	Finalised Project Brief
	O16.1	Updated Maintenance Plan
	O16.2	Production Information
	O16.3	Finalised Cost Plan
	O16.4	Finalised Site & Environmental Report
	O16.5	Updated Procurement Plan
	O16.6	Finalised Communication Strategy
	O16.7	Finalised Business Case
A42: Construct	O17	Finalised Handover Plan
	O18.1	Revised Maintenance Plan
	O18.2	Operational Product Model
	O18.3	Project Outcome Changes
A5: Hand-over	O19	Post Project Review

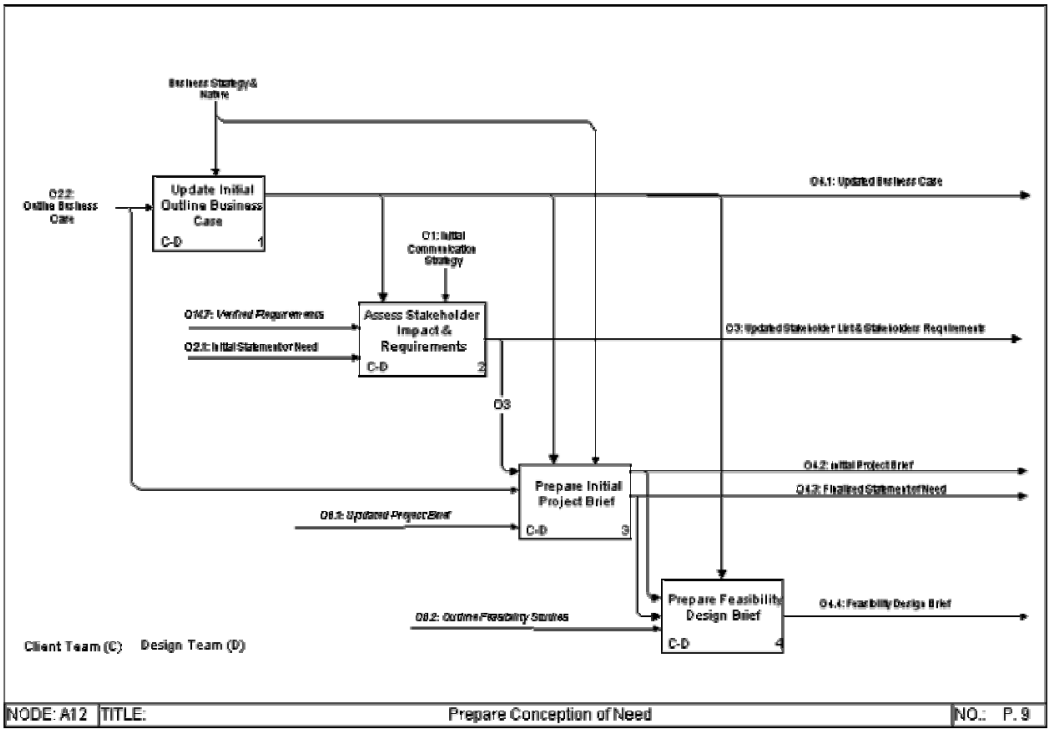

Figure 1. The CoBrITe Briefing Process Model

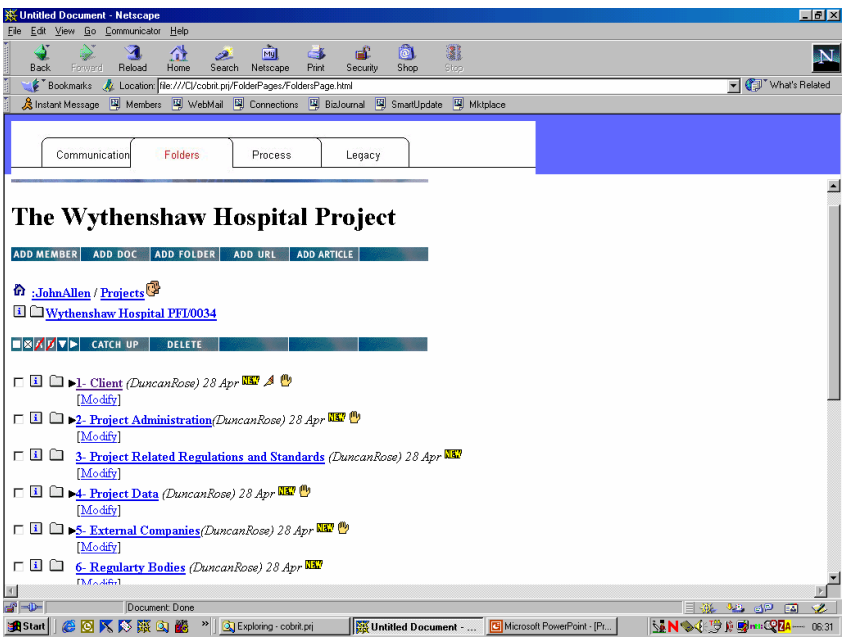

Figure 2. The CoBrITe – V0 Folders View.

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. The Process panel provides the process driven representation of the briefing lifecycle presented earlier. The V0 demonstrator was evaluated by the project partners and feedback obtained through a series of workshops, refinements were then introduced to the interface resulting in Version 1 of the prototype.

4.3 New Prototype (version v1)

A full working CoBrITe prototype was then developed, based on the feedback on the CoBrITe demonstrator described in the previous section and the project's software specification. This new prototype is completely autonomous in that it does no longer rely on the BSCW document web-server. It has been developed using open source technology (Java – APACHE web server). The panel on Figure 3 gives users access to all project information. They can use and invoke the services that they have the right to access, and can act on documents according to the rights conferred on their role in the project. This is set-up by the CoBrITe system administrator through a project management interface.

The innovative aspect of this new version of the CoBrITe prototype lies in its ability to integrate new services onto the CoBrITe platform. A service implements a specific function that is then made available to the user community through the CoBrITe portal. The core services that CoBrITe prototype provides include services to manage information, such as version information, upload information element and delete information element. They are invoked through their specific API call [17].

In addition, this new prototype offers a mechanism to group related information through the concept of "Access Group". Upon the creation of an access group the system administrator allocates a set of services that can be invoked from within the access group, as indicated in Figure 4.

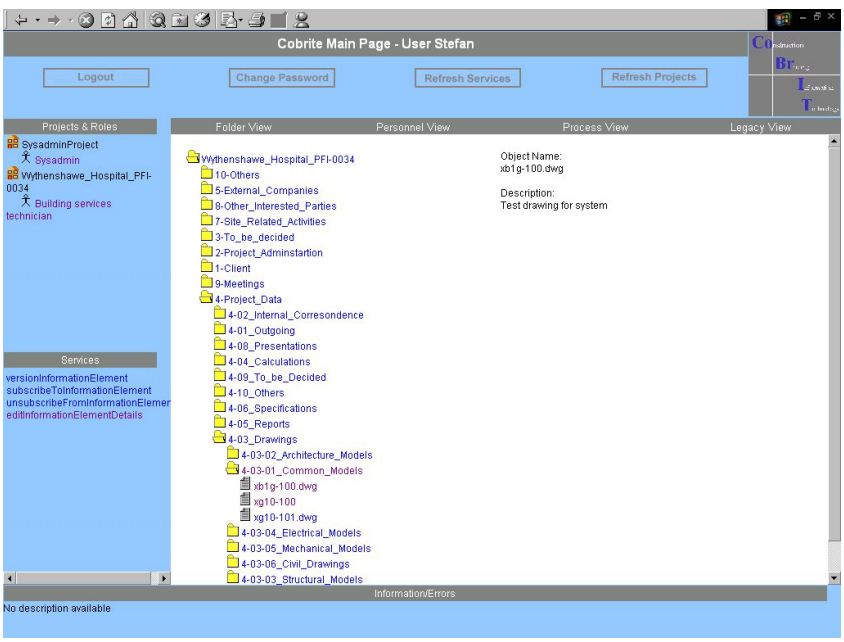

Figure 3. The CoBrITe – V1 Information Browser View.

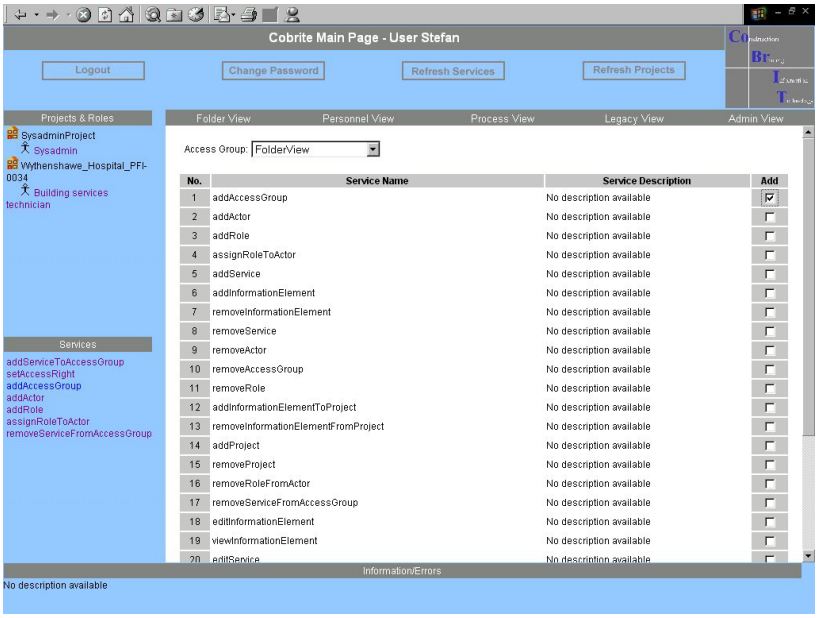

Figure 4. The CoBrITe – V1 Service Access Control View.

5 Conclusions

The paper presented an overview of the work undertaken in the CoBrITe project. The main characteristics of the briefing process have been discussed in the light of the current practice review with the industry collaborators, from which it is concluded that there are five proposed key areas for technological improvement, with regard to IT implementation.. Each is discussed and possible technology solutions identified. The project team has developed, by an iterative approach, a prototype CoBrITe system that addresses these areas and can act as an integrating environment to support construction briefing. It also provides a structured access to legacy data as well as ongoing projects information and knowledge.

A new autonomous prototype implemented using the JAVA technology has been developed, based on industrial feedback This is now being deployed within WS Atkins on the Wythenshaw Hospital project.

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