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A FRAMEWORK FOR IT USE AND INTEGRATION

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1. SYNOPSIS

There are several stages in developing and using information technology to deliver its full benefits to building design for the construction industry:

1. Specifying the user need
2. Developing application software
3. Testing and validating technical programs
4. Encouraging understanding and use of appropriate systems
5. Integrating individual applications across disciplines
6. Establishing the right standards and commercial framework for integration.

The first three of these are well established for energy and environmental software. There is a large amount of software available and a number of studies have compared the results from some of these. This paper is concerned with the last three stages.

In 1990/1 CICA carried out two studies for BRE and ETSU on why designers did, or did not, use the available energy software on their projects. The reasons for some groups, particularly architects and house builders, not using computers included: unfamiliarity with the software, lack of time to adapt, extra time involved and unwillingness of client to pay. There is therefore a need to provide guidance and reassurance that use of computer programs need not take much time or money.

CICA is carrying out a study for DOE to provide comparative information on the capabilities and limitations of different programs, presenting this in a form which any building designer can follow. One way to encourage use of programs which most designers would only need intermittently is to integrate them with other, more routine, software - CAD for example.

Integration of computer programs across the construction disciplines is not the most difficult part of providing a fully integrated building design process. The major problems are in standardising the way building data is organised, and providing reassurance to designers on the commercial and legal implications of data exchange. This is a role for professional institutions and trade associations and their current guidance on information technology is being studied for the Construction IT Forum.

2. THE CURRENT STATE OF INFORMATION TECHNOLOGY

Computer systems are now widely available and in use within individual construction industry firms to address particular tasks. The Building on IT for Quality survey by CICA and KPMG Peat Marwick, May 1993, shows that the ratio of computers or terminals to staff in large consultants has doubled in the last three years. There may be fewer staff now but there is one computer for every 3-4 people. There is also good software available. As a problem area, locating proven software has been getting less since these surveys were started ten years ago. What is increasing is the need to quantify the expected benefits. Technology is no longer taken on trust but the value of systems is being questioned.

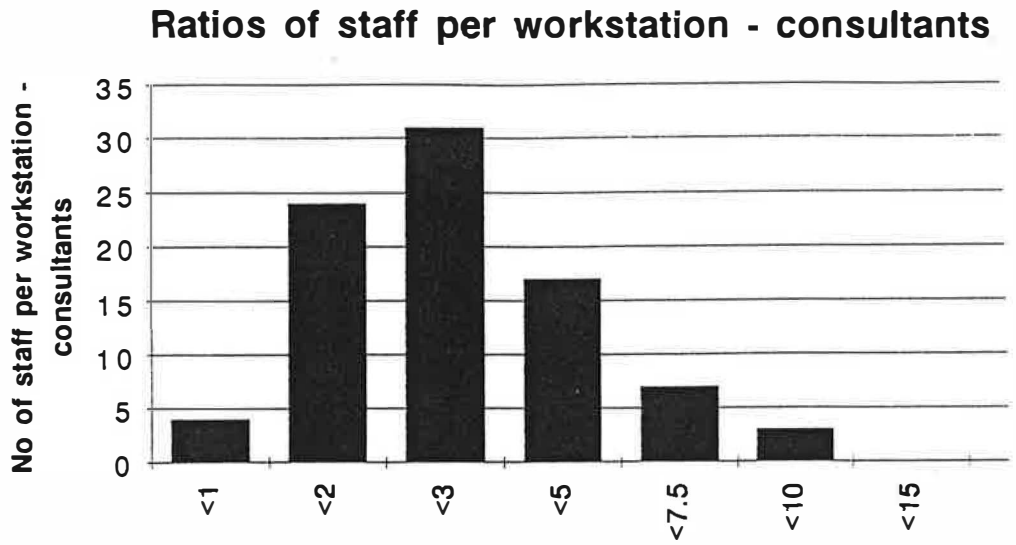


Fig 1 Ratio of numbers of staff in large consultants to computers, terminals, workstations.

3. BUILDING ENVIRONMENTAL & ENERGY DESIGN SURVEY

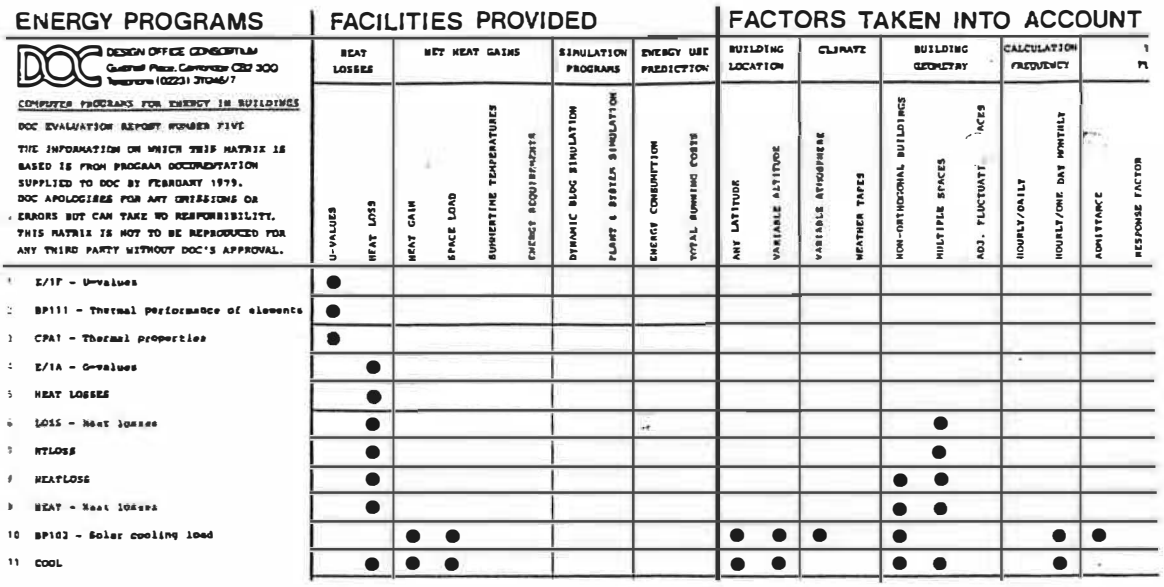
Outside the committed users of software there is much ignorance about the true costs and benefits of computing. The responses to the 'Building environmental and energy design survey' carried out by CICA for BRE & ETSU in 1990-1992 with Eclipse Research Consultants, showed that:

> Energy software is used by services consultants and local government but generally not by architects, house builders and housing associations.
>
> Many designers feel they will have to invest their time and money to learn about energy software.
>
> Their clients lack interest in, and are reluctant to pay extra for, energy assessment.

There was little doubt expressed about the accuracy of software but is was evident that there was much ignorance of the fact that there are simple, low cost programs which do not require great investment of time or money.

4. COMPARATIVE DATA ON ENERGY PROGRAMS

CICA will shortly be publishing the results of a study for DOE to present comparative data about a range of energy software from the simplest, which may encourage new users, to the most sophisticated which will allow complete building simulation and services design linked to CAD output. It is important that those in the industry unfamiliar with energy software can easily select appropriate systems and graduate to more thorough analysis when they are ready to do so. This follows a similar survey carried out in 1978 which presented the facilities provided, and factors taken into account, by the energy software then available. A similar matrix will be used to present the current work.



ENERGY PROGRAMS	FACILITIES PROVIDED								FACTORS TAKEN INTO ACCOUNT									
DOC DESIGN OFFICE CONSORTIUM Guildford Place, Cambridge CB2 3QQ Telephone (0223) 370467	HEAT LOSSES		NET HEAT GAINS				SIMULATION PROGRAMS		ENERGY USE PREDICTION		BUILDING LOCATION		CLIMATE		BUILDING GEOMETRY			CALCULATION FREQUENCY		
COMPUTER PROGRAMS FOR ENERGY IN BUILDINGS DOC EVALUATION REPORT NUMBER FIVE THE INFORMATION ON WHICH THIS MATRIX IS BASED IS FROM PROGRAM DOCUMENTATION SUPPLIED TO DOC BY FEBRUARY 1979. DOC APOLOGISES FOR ANY OMISSIONS OR ERRORS BUT CAN TAKE NO RESPONSIBILITY. THIS MATRIX IS NOT TO BE REPRODUCED FOR ANY THIRD PARTY WITHOUT DOC'S APPROVAL.	U-VALUES	HEAT LOSS	HEAT GAIN	SPACE LOAD	SUNPATTERN TEMPERATURES	ENERGY REQUIREMENTS	DYNAMIC BLDG SIMULATION	PLANT & SYSTEM SIMULATION	ENERGY CONSUMPTION	TYPICAL RUNNING COSTS	ANY LATITUDE	VARIABLE ALTITUDE	VARIABLE ATMOSPHERE	WEATHER TAPES	NON-ORTHOGONAL BUILDINGS	MULTIPLE SPACES	ADJ. FLUCTUATING SPACES	HOURLY/DAILY	HOURLY/ONE DAY MONTHLY	ADMITTANCE RESPONSE FACTOR
1 E/1F - U-values	●																			
2 BP111 - Thermal performance of elements	●																			
3 CPA1 - Thermal properties	●																			
4 E/1A - U-values		●																		
5 HEAT LOSSES		●																		
6 LOSS - Heat losses		●														●				
7 HTLOSS		●														●				
8 HEATLOSS		●													●	●				
9 HEAT - Heat losses		●													●	●				
10 BP103 - Solar cooling load			●	●							●	●	●		●				●	●
11 COOL		●	●	●							●	●			●	●			●	

Fig 2. Part of a matrix comparing facilities provided and factors taken into account by energy software in a study carried out for DOE in 1978 and being repeated in 1994

5. THE OPPORTUNITIES OFFERED BY COMMUNICATIONS

While benefits of computing are being questioned, new opportunities to link software and transfer data around project teams and around buildings are being opened up by communications. Some applications have realised their full potential within individual firms but can generate new benefits if they are linked to others.

The dream, which originated in the 70's, of a common building model to which all parties would have access has proved very elusive. Projects such as COMBINE and the STEP Product Modelling Standard are using new techniques such as object oriented software and data modelling to solve the problems that could not be solved outside system building before. To date the individual links between particular packages have proved more fruitful with services design software and CAD proving more effective. CAD systems conforming to standards, such as STEP, may eventually form the hub of the common building model.

Communications between different firms is more complex to establish. Whereas computers can be introduced unilaterally, it takes not just two to communicate but a community of like minded (and equipped) firms.

The Building on IT for Quality survey showed that expectations for growth of various communicating technologies are good but they will need to reach critical mass at about 30% penetration before they take off and, as fax did, climb rapidly towards saturation. The alternative, which may happen with EDI, is for the major players to insist on others using the technology to retain their business. This could come from large design/build contractors or clients.

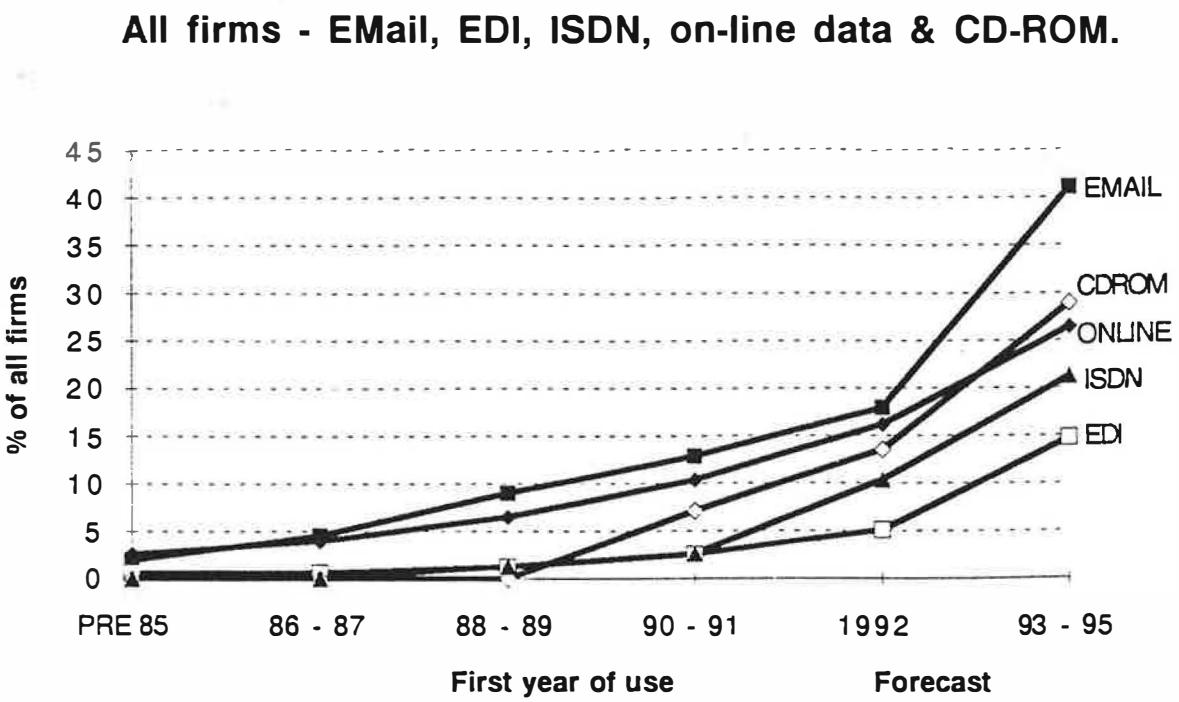


Fig 3. Communications systems in use and planned by large construction industry firms.

6. THE ROLE OF THE CONSTRUCTION IT FORUM

Another study, for which CICA acted as research co-ordinator, was Building IT 2000. This combined the views of 30 experts on the future of different aspects of construction and IT to predict the likely take up of systems by the year 2000 and identify inhibiting factors. It was clear that awareness of the significance of new technologies was not wide spread and that human and commercial factors were containing the use of existing systems as well as holding back new ones.

Another finding was that the opportunities for integration were limited by the rival interests of different groups in the construction industry. A commercial and legal framework was needed for data exchange and only the professional and trade bodies could provide this for their members. A single voice for IT in construction was required for this purpose and by DOE, and the Construction IT Forum was launched in 1993 to provide this.

7. COUNCIL MEMBERSHIP AND THE FIRST SERVICES

The Forum was not to be a new organisation with its own membership but a collaboration between existing ones. By October 1993 the following organisations were represented on its Council:

The Construction Industry Council
The Building Centre Trust
The Construction Industry Computing Association
The Building Research Establishment
The Construction Industry Training Board
The Department of the Environment
The Department of Trade & Industry
The National Council of Building Materials Producers.

With a limited budget its first activities are to provide IT Briefings to its member bodies, and those represented by them, for them to distribute to their members. The first of these covered Open Systems and was produced with the DTI Open Systems Unit. Others are planned on Building Models, EDI, CALS and CD-ROM. These are written in non-technical language to help inform senior management and others who may not be aware of the significance of technology and standards.

8. RESEARCH ON A FRAMEWORK FOR IT IN CONSTRUCTION

Research, in collaboration with others, is another role for the Construction IT Forum and the first project for DOE is to establish the current framework for guidance on IT to the industry, where there are gaps in services or support, to look at what is happening in some other countries and proposed necessary developments.

These will not be carried out by the Forum itself although it can help by providing support. A number if areas have been identified with the appropriate organisations proposed to help move them forward. Consultation will take place on these early in 1994 and some future activity can be reported after this.

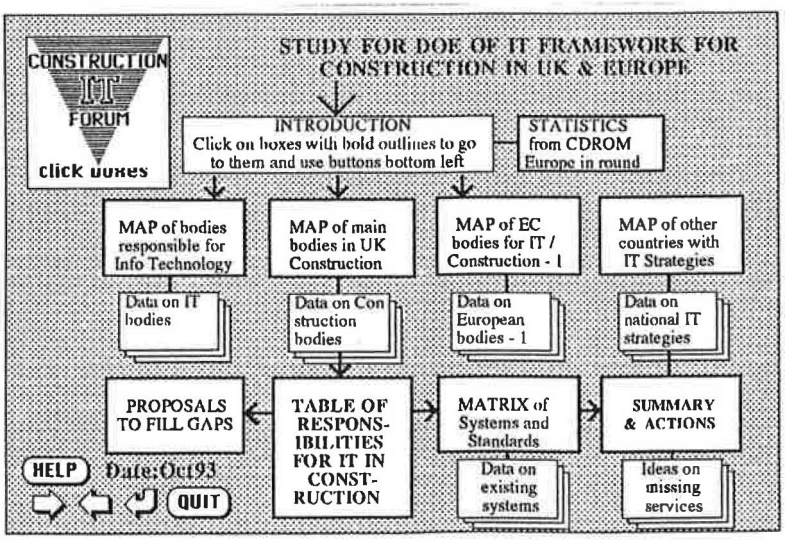


Fig 4. Outline of study for DOE on an IT Framework for the UK construction industry

Some of the topics are already being worked on but their importance for maximising the benefits from IT mean they need more support. Others, particularly those dependant upon human agreement as well as technology will take longer to get under way. Subjects include

Common building models for access by all
Quality assurance of software and its usage
Commercial value and liability for data
Comprehensive product libraries on CD-ROM
Standards for Building Management Systems
Exchange of quantities for electronic tendering
Multi-media links between sites and offices
National property databases
Common education for all building professions

A tentative timescale in which we can expect these developments to become available is:

POSSIBLE TIMESCALE FOR CURRENT AND FUTURE DEVELOPMENTS

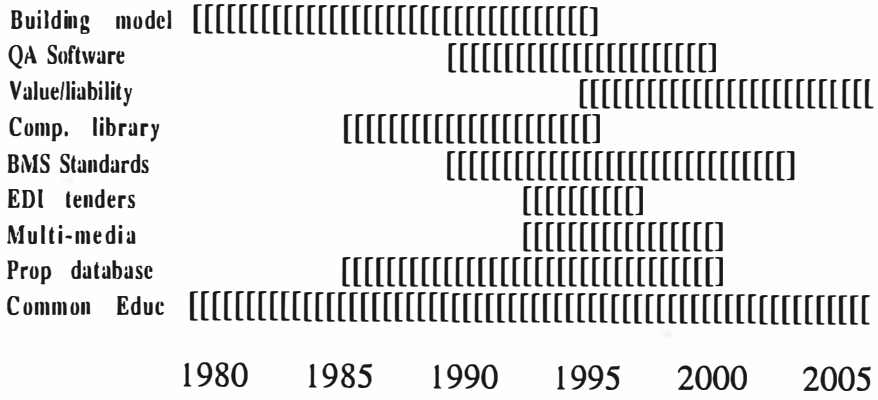


Fig 5. Possible timescale for implementation of some of the important developments in IT.

9. CONCLUSIONS

This research has shown that technology is being applied to construction industry problems in a way that all can use if they are well informed. Integration and data exchange standards are being developed but their use depends upon the right commercial framework.

Rivalries in the construction industry have not helped p ovide a better commercial environment. Each participant in the building process is seeking to find more work, not to accept data from others is a way which may undermine his role. Assurances are needed that specialist skills will not be supplanted by software or firms by-passed by communications.

A lead is needed from clients ideally but, if not, from lead consultants and contractors to establish a communications framework for a project to the benefit of all participants. The role of institutions and trade bodies, encouraged by the Construction IT Forum, is then to reassure their members that greater productivity and competitiveness world-wide, will bring benefits to all parties.

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