The use of the Internet by architectural practices in the UK

M. Fedeski Welsh School of Architecture, University of Wales, Cardiff, UK
B. Sidawi Welsh School of Architecture, University of Wales, Cardiff, UK

Abstract

Since its evolution in 1962, the Internet has provided new services for people and enriched their life and knowledge. Earlier research has shown that the architectural profession in the UK has lagged behind other businesses in adopting and using new technologies and is only slowly absorbing the new innovations brought by the Internet. This lag coincides with a slip in the architect's lead role in the design team.

The research conducted at Cardiff University aims to examine how architectural practices are interacting with the Internet and to investigate any problems they are having in its use. Architectural practices in the UK were surveyed and the results confirm that practices are under-using the Internet. Architects are experiencing difficulties in using the Internet which the study has related to a number of potential causes.

The paper discusses one aspect of this research, which is the use of the Internet in project design and management. The paper explains some reasons for the rare use of the Internet in design tasks and why practitioners are not certain about the potential benefit of the Internet. It makes recommendations for factors that should be targeted in order to extract more benefits from the Internet and to fully utilize it for project design and management.
The use of the Internet by architectural practices in the UK

Introduction
In recent times the architectural profession has been experiencing unprecedented social, economical, political and environmental stresses. Building design had to embrace more complex information, technology and aesthetics (Jencks 1993). Clients became not only more experienced, but also more demanding, with more sophisticated needs (Kliment 1996). Architects were not prepared for the effects that rapid change brought to the level of demand on their services, and were not sufficiently skilled in identifying newly emergent market requirements and adopting new technologies (Seidel et al 1995, Cuff 1991). Many were reluctant to use new technology in their practice. As an example, when computers were first introduced, many practitioners decided that they would be of no help to them in producing artistic design (Fryer 1997). In this changing environment, other professions were able to take up a new specialization in project management, shifting architects from their historical role as design team leaders to become equal players in the design team (Stevens 2000).

Recently, there has been a revolution in communications brought about by Internet technology, which has imposed itself on people, life and business. People around the world have become wired to the Internet through personal computers, handheld computers, mobile phones and digital TVs. The use made of the Internet and computers by architects has been studied in a number of surveys (see Barbour 1997; Barbour 1999; RIBA 1989; RIBA 1996; RIBA 2000). These showed that the trend towards the adoption and use of networking technologies by architectural practice has been slow, and lagging behind other professionals.

A literature review conducted by the authors suggested that the Internet nevertheless has considerable potential for architectural practices, by supporting the recent use of computer tools, providing extra communication channels, and extending architects’ abilities and expertise in new ways. By taking greater initiative in the adoption of these technologies, architects might be able to gain back some of the ground they have lost in the design team.

Research theme
Part of the aim of the present research was to show how the Internet is being used by architectural practices. The range of uses to which architects put the Internet was compared with the potential uses available to them, and this revealed a number of shortcomings. Explanations for these shortcomings were then sought.

A sample survey was used to collect the required information about practices in 1999. There were two samples: a stratified random sample of 60 RIBA private practices and a random sample of 18 local authority practices. Information was collected by structured questionnaire. The questionnaire was targeted at the principal of the practice, and in most cases was completed by this person, or by others on his or her behalf. It supplied data about the use of the Internet and about some of the explanatory factors in a form that could be analysed statistically. This analysis will be referred to in what follows as the 'survey'.

A sub-sample of seven of the respondents were interviewed at their practices (referred to as the first interviews) to find out more about their attitudes towards the Internet. Observation at this time, and more protracted observation of one particular practice, provided additional insight.

After the main results had been compiled, there were follow-up interviews with thirteen of the respondents. These were designed to test whether the recommendations being made were realistic.
The sampling method used for the survey allows the results for the private practices to be projected with some confidence on the population. However, there were too few responses from local authorities to give this confidence, so that from an inferential point of view, all other results must be treated with caution.

**General view of Internet use in architectural practices**

Most private practices, and half local authority practices, report that the two purposes for which architects use the Internet most are e-mailing and obtaining professional information. Other Internet services are hardly used by architects or, in private practices, by architectural and CAD technicians. 70% of practices said that the services professional staff and architectural technicians make greatest use of are e-mail and other text communication, and the World Wide Web. In half the practices, CAD & computer technicians use e-mail but make little use of other services. The comparison of results between private and local authority practices shows that Internet services are used mostly by architects in the private practices, whereas the use is relatively more spread among the design team and other staff in the local authority practices.

Most private practices have exchanged informal file format types with the outside world. Nearly half of them exchange formal letters through the Internet. Half of local authority practices exchange graphic files with people outside the practice. But few practices exchange other file formats. Only 13% of both practices use the Internet to exchange video and audio files.

The study finds that a high percentage of local authority and private practices (i.e. more than 80%) do not use some of the more direct communication services, whether instant services such as video conferencing, chat, and project home page, or non-instant such as newsgroup, bulletin boards, and discussion groups.

These results suggest that the Internet is under-used by practices, in that:

- Many practices do not exchange graphic, DTP (i.e. Data Transfer Protocol) and HTML (i.e. Hyper Text Markup Language) information over the Internet;
- Many practices do not use some non instant and instant communication services;
- In-house design staff do not use all Internet services;
- Some design staff use more Internet services than other staff.

An analysis of the survey results was undertaken to help explain this under-use. Various factors included in the survey could be tested as explanatory variables using simple statistical tools such as cross tabulation. Cramers’ test of correlation was used to examine the strength of the relationship, and the Chi-square Pearson test to measure its significance; results with a significance level below 0.05 were accepted.

**Characteristics of the practice**

The size of the practice is found to relate to Internet use, the data suggesting that smaller practices are hindered in making good use of the Internet. Internet uses that suffer in smaller practices are the use of audio-visual communication services (e.g. video conferencing) by architects and architectural technicians, and the use of audio communication services (e.g. Voicenet) by architectural technicians. Most (i.e. 90%) of the private practices surveyed have under five professional staff.

Another characteristic of practices that has an effect on their use of the Internet is their turnover, as indicated by the size of the projects they undertake and the rise or fall in work load. 10% of private practices and 40% of local authority practices had handled projects with a total value exceeding £10
million in the year before the survey; at the other end of the scale, 32% and 5% respectively handled projects with a total value below £500,000. In the practices with higher project values, more architectural technicians use audio-visual and audio communication services, and more architects are using text communication services other than e-mail.

More than half the practices said they were as busy or busier than in the previous year. In the practices whose work loads are on the increase, more architects are using audio communication services.

The importance of financial resources was verified in the first interviews. Interviewees said that they evaluate the use of any Internet service according to available funding. One, when asked about the possibility of using the Internet to transfer remote video pictures, replied that it comes down to the budget. He commented: “a lot of people here like to have new technology, but because of budget, some of the Internet tools are out of our reach”. A principal who had been pointing to the expense of computer technology went on: “but people like me can not afford to buy it all the time; I am trying to upgrade what I have because it is a lot cheaper”.

**The Internet system**

The length of time practices have been connected to the Internet has some bearing on usage. 13% of private practices have no Internet connection, 70% connected in or after 1997 and 17% have a history of use going back before 1997. 90% of local authority practices connected to the Internet in 1997 or after. The survey showed that in those practices with a longer history of using the Internet, more computer, CAD and IT technicians make use of audio-visual, audio, and text communication services other than e-mail.

86% of the private practices sampled are connected to the Internet, and they are the main subject of this research. However, some practices are connected to other types of network. 35% of practices have a second network, either extranet or intranet, and 3% have all three types of network. 52% of LA practices have Internet, 72% have two networks, and around 5% have three types of network. The survey shows that this rough measure of the degree of network connectivity relates to Internet use. In practices that have more of these network types, more computer and CAD technicians and architects are using Internet services, particularly the World Wide Web, e-mail, and access to professional information. For instance, computer and CAD technicians who are in practices which have an Internet network use the e-mail service only, whereas those who work in practices which have both external and internal networks use more Internet services, whilst even more services are used by IT technicians in practices which have three types of network. The type of network also relates to the frequency of use of exchange services for graphic files, and of communication services using text (other than e-mail).

Most practices (i.e. 80%) reported that they have less than six computers connected to the Internet. More than two thirds of LA practices have less than six computers connected to the Internet. The survey results showed that some Internet services get more frequent use in practices having more computers connected to the Internet. These are audio-visual and audio communication services, and the World Wide Web.

**The users’ knowledge of IT**

The survey respondents were asked to assess the knowledge of their staff about Information Technology (IT). In private practices most respondents think that their architects and administrative staff have only average knowledge of IT, whilst their CAD staff, architectural technicians, and other professional staff are more knowledgeable. Other staff are considered to have low knowledge of IT. In local authority practices, the pattern is similar, with architects and
architectural technicians having average knowledge of IT, and computer, CAD, and IT staff and other professional staff being more knowledgeable. Other staff are again considered to have low knowledge of IT.

The study found that the IT knowledge of the design team is related to its use of the Internet for some design tasks. For instance, professional staff thought by their principals to have greater IT knowledge make more use of the Internet for downloading computer software. Again, CAD & computer technicians and architectural technicians with greater IT knowledge make more use of the Internet for exchanging HTML files and DTP files respectively.

The first interviews indicated that some practices have problems in exchanging files through the Internet because their staff have insufficient knowledge of IT, which may explain the low use of the file exchange service. This problem was highlighted by one interviewee who pointed to problems when sending large or incompatible files to other consultants. He linked such problems to the level of understanding of staff, saying that there is sometimes a misunderstanding between staff who were separated by a great distance about what should be done. The observation showed that staff with only a passing or average knowledge of IT can create compatibility problems by making and exchanging non-standard files.

A focused view: Internet use for project design and management
So far, results have been presented about the general use of the Internet in architectural practices. The presentation now moves on to consider more specific uses of the Internet to assist in project design and management. A similar sequence is followed: the extent of Internet use for this purpose in practices will be examined and, shortcomings having been demonstrated, explanations will be sought.

The survey asked practices about the use of design-related information that is available on the web such as technical information and manufacturers' information. At least half of the practices said that they use manufacturers’ information, with a similar proportion using technical information.

It also asked them about the Internet's influence on design tasks. They thought that the Internet has a positive effect on communication between members of the design team and it has some positive influence on the quantity and quality of information available for design. Local authority practices thought that it also had a positive effect on the time taken for project design and construction, but private practices thought that it had a small negative influence on this.

The practices were asked in the survey about the likelihood of using the Internet in some design tasks in the foreseeable future. Local authority practices said that they were likely to use the Internet for discussing design sketches through the Internet and viewing remote drawings. However, all practices seem unsure about other such uses. They all said they were unlikely to use the Internet for downloading information to integrate into drawings and specifications, for discussing a sketch with the client, or for inviting the public to become involved in design decisions about public projects.

These results show that the Internet is not used to assist design in architectural practices to the extent that it might be. Many other ways can be suggested in which the Internet could help. For instance, it would be possible for architects to use the Internet to send free faxes and voicemails, to use freeware applications, to download CAD objects, to share design information online, to discuss 3D design models in real time with clients by using online virtual reality tools, to incorporate design information into intelligent 3D objects, and to view and mark up any type of document without the need to have the full software in-house. However, it must not be supposed without
good evidence that architects will actually find such potential applications useful in practice or relevant to their needs.

For this reason, follow-up interviews were carried out to test the opinion of a sample of architects on potential uses of the Internet. The subjects were shown a presentation about a number of advanced applications of the Internet for design tasks, and asked whether they would find them useful (see the table below). To get an idea of how useful they would be, they were also asked to assess, where applicable, what project savings, what size of project, and what distance of project would be needed before they would adopt the application.

More than half of the interviewees agreed that some of the suggested applications were potentially useful (the first five applications in the table). More than half of them said that they would be happy to use the Internet for automatically checking building design compliance with regulations, and for exchanging project information with standard pro-formas, whatever the project size and even if the project were next door.

Of the suggestions made to them, the one to which they applied the strictest constraints, that is, found the least useful, was the use of a 3D building model incorporating cost and purchase data to share information with members of the design team over the World Wide Web.

The interviewees considered that there are other constraints that could also play an important role in deciding the potential use of the Internet in design tasks, such as the type of CAD packages used by the practice, the complexity of the project, and whether the design information exchanged with other parties is parametric or non-parametric. They thought that whether they will make more use of Internet services for design will be influenced by the efficiency of the services provided, and by the ability of the Internet to act as an intelligent system capable of identifying and knowing the designer's needs.
<table>
<thead>
<tr>
<th>Constraint type</th>
<th>Usefulness</th>
<th>Required saving</th>
<th>Project size</th>
<th>Project distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of constraint</td>
<td>Useful</td>
<td>Would be applied even if less than 1% of the project expenses are achieved</td>
<td>Would be used whatever the project size</td>
<td>Would be used even if the project is next door</td>
</tr>
<tr>
<td>The type of design task</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sharing project documents</td>
<td>X</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Automatically checking building design compliance with regulations</td>
<td>X</td>
<td>-</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Using specifications, technical indexes, and standards on-line</td>
<td>X</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Virtual reality and visualization of 3D building models</td>
<td>X</td>
<td>-</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Exchanging project information with standard pro-formas made available on the Internet.</td>
<td>X</td>
<td>-</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Collaborating, meeting, communicating and discussing project issues with other project team members</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sorting out design problems &amp; conflicts on-line</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Improving the quality of project design and construction</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>-</td>
</tr>
<tr>
<td>Hyperlinking design information with on line manufacturers' products, and technical information</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Sharing a 3D building model incorporating building cost data with design parties on the Web</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

X: more than half of interviewees agreed to use the Internet potentials under this level of constraint
-: The rest of the interviewees who do not agree to use the Internet potentials under this level of constraint, and they apply a medium or high constraint level on these potentials

Table 1: Potential uses of the Internet to assist project design and management found most useful by practitioners interviewed
The results of the survey and the follow-up interviews together suggest that practices could make greater use of the Internet to assist them in project design and management:

- Online design information is used by only half of the practices;
- Practitioners have divided opinions on whether the Internet has a positive or negative influence on the time taken for project design and management tasks;
- The potential of Internet use in design is not realised by many practices.

As before, explanations for this under-use were sought by analysing the survey data for correlating variables.

A link is shown between the first problem listed (i.e. little use of on-line information) and the design staff’s knowledge of IT. For instance, the use of manufacturers' information services is greater in practices whose architectural technicians have more knowledge of IT, and the use of technical information is greater in those whose architects have more knowledge of IT. The first interviews suggested other causes to the problem. Practitioners said that they found hard copies of technical and manufacturers' information easier to use and digest, and one of them, who has Mac system, said that his system “is not compatible with information sent by manufacturers and technical information. I have difficulty to find information on line.”

Regarding the other two problems listed, the study suggests that they are related: a reluctance to realise the potential of the Internet reflects a poor impression so far of the Internet's influence on project design and management. That is, what respondents say about their intention to use the Internet for new design tasks in the near future is related to their degree of satisfaction to date with the Internet's influence on related design tasks. In particular, the likelihood that practices will use the Internet for managing design tasks in the office, or for communicating with outside people, increases alongside their satisfaction with the Internet's present influence both on project management and on communications with the design team.

Thus, a negative attitude towards computers may explain the under-use of the Internet in design. The first interviews showed how some practitioners do not like to use computers. One practitioner explained: “The reason that I do not use the computer is that I do fast sketches and follow my brain. If I am doing this sort of thing by computer, I cannot catch up, and it would be very frustrating to me. I would have to think how to use the computer rather than what I am doing”. Another pointed out the unsuitability of the Internet for evaluating building products: “by not seeing the building components in exhibitions or getting samples, you will not get an indication of quality”.

Dissatisfaction with the Internet's role in project design and management is probably a result of problems encountered in using its services. Such problems are, at least in part, due to inexperience.

The first interviews showed how the interviewees’ level of IT knowledge could be a potential cause. During the interviews, their knowledge was tested, and the results provided clear evidence that not only do they not use many Internet services but that these services are unknown to them. Furthermore, the tests revealed difficulties that they were finding in interacting with some of the services, such as search engines and professional guidance on line, which they considered to be non-friendly.

Some interviewees referred to problems from outside the practice, with partners or clients who have little awareness or knowledge of computers. One principal mentioned that some of his clients do not have the Internet. This prevents the practice from using the Internet effectively in this area. He
tried once to send a 3D model, with viewing software, to a client who uses the Internet, but found that he needed to demonstrate in person how to use it.

The first interviews showed that some interviewees had no clear plans about how to use the Internet for design tasks in the near future. This supports the survey figures, which show uncertainty towards the use of the Internet in design in the foreseeable future. However, there were interviewees who have plans, and said that they are planning to make links with associates or partners in business through the Internet and to manage projects on line. Some practices are looking forward to utilizing the web for distributing information, performing electronic transactions, selling 3D models to other Internet users, and doing remote inspections on defective buildings.

Summary and conclusion
This paper makes the case that the Internet is under-used in architectural practices and that, more specifically, much of its potential use for project design and management is unrealised. The questionnaire survey and interviews suggest some of the hindrances to a greater adoption of Internet services.

Smaller practices and those with lesser financial resources use a more limited range of media on the Internet. The more years that practices have been connected, the greater the use that staff make of these media. The degree of connectivity that practices have, in terms of the number of networks and the number of connected computers, the more engaged with the Internet the staff become. These results suggest that access and experience are important factors in creating an environment in which the Internet is used fully.

Insufficient knowledge of IT generally, and of its potential benefits in particular, is a significant barrier to staff engagement with the Internet. Staff have to develop new skills to use Internet services, and need support whilst doing so. This problem is exacerbated when services do not match their requirements well.

Poor skills lead to difficulties in using Internet services. Difficulties encountered in using the Internet now, give rise to dissatisfaction with the services. This dissatisfaction relates strongly to the staff’s readiness to explore the further potential of the Internet to help them with project design and management.

Nevertheless, there are practitioners who do make good use of the Internet. Practitioners, when asked, are able to see how useful some of the services they have not yet adopted can be. Some practitioners do have plans to tap their potential in the future.

If it is accepted that the Internet can bring benefits to practices, then ways must be found of overcoming the hindrances. This is important for the efficiency of architectural practice and for its ability to keep abreast of change in the industry. Some possible targets have been suggested by this research, and these are now expanded upon.

The components of the Internet system, including the software and hardware, are in need of regular updating and upgrading. Such procedures enable practices to utilise Internet resources more fully. Setting up and maintaining a system to give a sufficient standard of service would seem to require more funding than small practices can spare. How such a shortfall might be bridged is a matter to be debated.

Architectural staff must learn how better to implement the Internet in project design and management. With the rapid development of the Internet they will need to know, for example, how
to lead virtual design teams and manage remote information and data. It is important to realise that not all staff will manage this without support. The vicious cycle from past inexperience to dissatisfaction and onward to future inexperience, as outlined above, will hold many back.

Support could come from within practices, but present experience suggests that this has been insufficient to date. Consequently, some external support is needed, either through the practice or for practitioners directly. It would seem that the objective should be greater exposure to the Internet, which would build up experience, and help to break out of the cycle. Given a better chance to experience the Internet environment and to become more familiar with it, practitioners will be better able to perceive its benefits for themselves.

The implication is that some part of the necessary support should be delivered over the Internet, in conjunction with appropriate services. However, the present inertia found by the research to the take-up of new ideas over the Internet makes this only a partial route. At the very least, a programme of publicity, guidance and incentives is needed to back up the available support.

The conclusion towards which this line of reasoning leads, is that a lead needs to be taken by an influential organisation in co-ordinating the necessary steps. The professional institutes are the obvious candidates. Whatever the extent of their intervention, their leadership could prove valuable.
References


