
EXTRANET TECHNOLOGY IN SMALL AND MEDIUM SIZE CONSTRUCTION COMPANIES

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ABSTRACT

Project extranets have been used in construction for the last 10 years and research shows that there are many benefits to their use. However, their use has not been taken on by all firms. A project extranet as a web-based portal allows subscribers to securely share information over the internet. This research looks into the drivers and barriers faced by small and medium sized contractor and house builder companies in terms of employing extranets on construction projects.

The objectives of this research are to identify the characteristics of contractor and house builder companies in the UK, to identify the extent to which project extranets are used and to investigate the drivers and barriers to contractor and house builder companies of using project extranets.

Extranets have the potential to improve traditional processes by improving communication and document and information transfer between the vast numbers of organisations that can be involved on a construction project. Yet it is found that many contractor and house builder organisation are facing barriers such as the perceived expense of the systems and time required for implementation and training. The construction industry needs to overcome these perceived barriers in order to reap the benefits that extranets can provide.

This research forms a scoping study as a basis for further research into the drivers and barriers of extranets for the wider industry. Semi-structure interviews were used as the primary method of data collection, companies' policy documents and other literature were also reviewed to assist the entire data collection process.

KEYWORDS: Extranet, Technology, Efficiency, Construction, Collaboration

1 BACKGROUND

The construction industry is characterised by its fragmentation and poor coordination. Construction projects require the coming together of many different parties to form a project team. The project team needs to be able to communicate and transfer data effectively between the different organisations. However, the various companies IT systems can be diverse and therefore the sharing of information can become problematic. A large amount of data and information is generated during each phase of a construction project lifecycle. Using traditional methods of communication there are often deficiencies in terms of the consistency and adequacy in the creation and transfer of the vast amounts of information generated during the construction project. Data storage is also an issue and much of the data generated resides in inaccessible storage areas or gets misplaced. Problems arise from the lack of information capture or loss of information itself when moving across the different teams and parties; these can be loss of design related information, loss of construction/ production related information, or loss of operation and maintenance related information. It is necessary to find ways to improve the communication channels, towards better information exchange, collaboration, and as a result product innovation in construction sector (Larsson, Sundqvist and Emmitt 2006). According to Pekerikli 2010, unavailability of data and information has two consequences: (1) it negatively impacts the cost of processes at each consecutive lifecycle phase and (2) it hinders any opportunities for the improvement of these processes, resulting from failure to feedback, learn and update. (Pekerikli 2010)

Extranets have the capabilities to mitigate these issues by bringing together and storing up to date information in one place on an IT system that is compatible with that of all the different organisations in the project team. They allow the easy transfer and sharing of information between parties and allow it to be stored in an easily accessible way.

Past unpublished research carried out by one of the authors of this paper found that in the year 2000 project extranets were a relatively new technology and were beginning to be introduced in the construction industry. However, there were very few companies that were using them and their use was very limited. They were mainly used as a space to store drawings. The interfaces at this time were also not as developed. They were mainly a shared folder on a network drive, rather than the web based portals that they are today.

The use of project extranets in the construction industry has developed over the last 10 years and there are many benefits to their use (Chan 2007; Ahuja, Yang and Shankar 2009). However, their use has not been taken on by all firms. This research therefore looks into the barriers faced by small and medium sized contractors and house builder companies in terms of employing extranets.

2 METHODOLOGY

The construction industry is very large and diverse. The main categories of stakeholder are clients, consultants and contractors. In view of the scale of the sector and the time lapse since the previous study by one of the authors in 2000, the researchers decided to carry out an initial scoping study focussing on one of the industry groups, to get a representation of what is happening now. This information could then be used to design a wider industry survey.

The contractors sector was chosen because this group forms a major part of the construction industry in the UK and they work with all the other stakeholders, so should be able to provide a good overview of the current use of extranets in the industry and the benefits and barriers to their use. The researchers decided to focus on small to medium size contractor and house builder companies in the UK, as they make up the largest proportion of private contractors based on construction statistics for 2010. (Office of national statistics 2010)

This scoping study used semi-structure interviews conducted with contractors and house builders as the primary method of data collection. The interviews were aimed gathering qualitative data through dialogue that could provide an in depth understanding of the extent of the use of extranets and the drivers and barriers to their use. Interviewees from eight companies were identified for this study. They were selected as they are key people within their organisations and because they were very supportive of the research concept and wanted to be actively involved.

Companies' policy documents and relevant literature were reviewed to inform the design of the interviews for the scoping study and to underpin the analysis of the findings, in order to draw conclusions about the best approach to formulating a wider industry study.

This paper now presents the research findings from the scoping study through a discussion of evidence from the literature under the following headings:

- the characteristics of contractor and house builder companies in the UK;
- the concept of extranets;
- the need for extranets
- the extent of the use of extranets in the UK
- the benefits of extranets
- barriers to the use of extranets

Findings from the interviews are then presented and conclusions drawn about the best way forward for a further study.

3 THE CHARACTERISTICS OF CONTRACTOR AND HOUSE BUILDER COMPANIES IN THE UK

There are just under 200,000 private contractor companies in the UK. 99% of these are small to medium size firms employing less than 80 people. Just over 10,500 of these firms are involved in non-residential building and just over 27,500 are involved in house building. The other firms are made up of civil engineering and other specialist trades (Construction statistics annual 2010). Therefore small

to medium size contractor and house builder firms represent a vast proportion of the construction sector.

Many of the firms work within their local areas as building projects are often unique and one off and therefore they do not do not favour centralised mass-production of the sort which gives rise to economies of scale. Capital requirements for contractors are also low, skills such as bricklaying are not easily mechanised and the need for expensive fixed capital is minimal. Firms are able to hire plant as and when required, so do not have to use capital to buy plant. Smaller firms are also able to work on larger jobs without needing to have much capital, as they can subcontractor for larger firms. There are minimal entry barriers to the industry. Not only is very little capital required, there is also little necessity for formal qualifications such as certificates of competence or membership of trade associations. As many of the smaller firms specialise in particular trades and work within their locality it is possible for many smaller firms to be a part of the industry. (CEM 2002)

House builder companies may either be developers building homes to sell for themselves or they may be building homes for other clients. The products of the house builders are often standardized and therefore they can make greater use of standardized products and economies of scale.

Communication between different parties for most companies is essentially paper work based, as the supply chain and also other smaller subcontractors they work with do not use any advanced technology for communication.

4 THE CONCEPT OF EXTRANETS

The Construction News Plus websites define Project extranets as, “ External, closed computer network which connects together members of different groups or companies, normally via Internet connections and using a browser; differs from the internet in that membership and the Extranet is restricted, normally by individual or group user ID’s and passwords.” (Construction News Plus undated) In basic terms extranets are a mid point between The Internet and the company’s intranet, as these are described as “...the two major components of an extranet...” (Volsky, Fontenot and Blalock 2000). Therefore, it is necessary to firstly understand what the internet and intranets are. Kirkwood says, “In its simplest form the Internet is a network of computers linked worldwide.”(Kirkwood 1994). The company intranet is a like a mini Internet, in that it links a network of computers within the firm together usually using an Internet connection, but the information stored on it is not accessible by anyone outside of the firm thus, it is a private network. The Construction News Plus website defines an intranet as, “Internal, closed computer network linking members of the same company or group together normally via Internet connections and using a browser.” (Construction News Plus, undated). “A company may use an intranet to facilitate communications among its members and deliver information and services to employees. This is particularly useful in large, multi-site organizations.” (Volsky, Fontenot and Blalock 2000) Table 1 illustrates the differences between internet, intranets and extranets.

Table 1: Similarities and differences between the Internet, intranets and extranets (Volsky, Fontenot and Blalock 2000)

	Internet	Intranets	Extranets
What is it?	The information superhighway	The use of Internet technology within a company or organization	A network that uses the Internet to link company intranets in order to enhance business-to-business relationships
Access	Open	Private	By agreement only
Users	Public	Organization members	Business partners
Information	General	Proprietary	Selective

For the basis of this research, extranets are defined as a web-based portal that allows subscribers to securely share information over the internet. In the context of construction, it is envisaged that they are

used for communication between the project team and to store drawings and other project documentation.

5 NEED FOR EXTRANETS

As discussed, there are deficiencies in terms of the consistency and adequacy in the creation and transfer of the vast amounts of information generated during the construction project and much of the documentation from a construction project can be inaccessible. In the construction sector, information is generally not immediately available for future use due to organisational obstacles and deficiencies in creating structured and formal information (Scott and Harris 1998; Knauseder, Josephson and Styhre 2007; Schindler and Eppler 2003). The construction sector needs a reliable, systematic and coherent information collection and recording approach for the activities taking place in the build environment, preferably with a direct relationship to the design and construction process and documentation. Effective implementation of IT within projects, and the construction industry would greatly improve the process of communication and improved communication will provide a number of benefits (Ahuja, Yang and Shankar 2009) The Egan report “Rethinking Construction” also suggests that there is a need for improvements in quality and efficiency in the construction industry (Egan 1998). Egan identified five key drivers of change in his report, one of which was integrated processes and teams. Project extranets provide a secure link between the different institutions making up the team; thus, they encourage integration and teamwork by providing a framework for increased communication. “Extranets can facilitate the sharing of information.” (Vlosky, Fontenot and Blalock 2000)

6 SOFTWARE AND FUNCTIONALITY OF EXTRANET

Over the last 10 years, the functionality of extranets has vastly improved and they now have a number of uses and useful tools such as electronic measurement, project calendars and instant messaging and can be used as a facilitator for e-tendering and BIM. The key extranets software currently used in the construction industry are Asite, BIW, Project 4 and Buzzsaw. These companies are continuously improving the functionality of their products. Extranets have gone from being simple shared folders and have developed into multifunctional portals for communication that are the centre point for collaboration with the project team. In the future, the use of extranets for E-tendering will increase as functionality improves and user confidence grows. “Paul Morrell, the government’s chief construction adviser, has indicated that publically procured building projects will be required to adopt building information modelling.” (Kennett 2010) This indicates that extranet use for BIM will be a key area of future development.

7 THE EXTENT OF USE OF EXTRANETS IN THE CONSTRUCTION INDUSTRY

In 2000, Volosky, Fontenot and Blalock reported six main uses for project extranets (Volosky, Fontenot and Blalock 2000):

1. Electronic communication with trading partners
2. Customer contacts
3. Vendor contacts
4. Sales to customers
5. Product and service promotion
6. Purchases from suppliers

These are uses of extranets in general business. This shows that communication is one of the key uses of extranets. Other research also supports this view, “Extranets will make it easier to share database and other non-transaction types of communications among enterprises.”(Taylor 1997) Better communication creates better relationships between parties, which can have other knock on benefits. “Many claims are made that the real value of web based customer services is not direct sales, but rather improved customer relations that retain customers.”(Middelbow 2001) “Extranets can also improve customer service,” (Taylor 1997). The emergence of extranets in the era of e-commerce whilst referring to data from a study done by ActivMedia, inc. say, “...these companies who have recognized the importance that communication has to their business and the improvement that can be made by offering information via an extranet to better serve its channel of customers” (Bullock 2000). Construction is a diverse industry and projects bring together many different organisations that need to collaborate. In the construction industry, intranet extranet (IE) has represented a “Low Barrier”

technology that has enabled new ways of doing business, vital in the complex environment of the industry with its need for intensive information exchange, and collaboration between project partners (Wong 2007).

Independent research by the Network for construction collaboration technology providers NCCTP found that “over 80% of contractors/suppliers believe that larger clients are increasingly moving in the direction of insisting that people who work with them are proficient in using this technology.” Therefore, clients are a key driver in increasing the extent of use of extranets.

8 THE BENEFITS OF EXTRANETS

Construction project extranets as communication technologies are aimed at supporting the entire construction process. Past research has highlighted a number of benefits of extranets both in general business and when used in the construction industry. The major benefit of the extranet is its speed information can reach the recipients within minutes.

In the research done by Richard P Vlosky, Renee Fontenot and Lydia Blalock, the sample rated, “Timeliness of information exchange,” (Vlosky, Fontenot and Blalock 2000) as the top benefit of having an extranet. Apart from the general benefits from this, this could be specifically beneficial in construction in that, if there is a variation the contractor can receive warning of this almost immediately, which may stop him from carrying out some work or buying materials that may not be needed and will cause an extra expense to the client. This research also outlined the principle gains that businesses anticipate from the development of extranets. They are as follows:

- Shared information and data;
- Reductions in operating costs;
- Savings in time and resources;
- Improvements in customer service; and
- Better relationships along the supply chain and with other partners.

Independent research was commissioned by the NCCTP and surveyed 272 end users in order to “provide a representative quantifiable measure of the various different benefits identified by people with first hand experience of using collaboration technology on live projects.” The aim was to overcome scepticism amongst potential end users that information provided by extranet providers was biased and not a true reflection of the benefits the technology can bring. The research found that “96% of people that have made use of collaboration technology are happy that it has benefitted their business.” This is also apparent from research by Wong (2007) who found that “...all the interviewees stated that the uptake of internet extranet (IE) had achieved or exceed the expected benefits...These include: increased speed of communication, ease of document exchange and information dissemination, improved knowledge sharing within geographically-dispersed virtual teams, and enhanced business profile.” The NCCTP research also established the benefits that the end users had found in terms of using extranets as follows:

Table 2: End user benefits. Adapted from NCCTP Proving collaboration pays study report (2006)

Level of benefit	Benefit
Over 80% of users found the following to be substantial benefits they had experienced:	<ul style="list-style-type: none"> • In enabling them to access documents 24/7 • In ensuring that project management information was available to everyone centrally. • In cutting the amount of money spent on post and on couriers. • In reducing the chance that important documents might be lost. • In providing a better overall audit trail.
Over 70% users found the following to be substantial benefits they had experienced :	<ul style="list-style-type: none"> • Better traceability/visibility of documentation. • Improved information security. • Reduced costs associated with distribution/production of documents. • Better accountability for all parties involved in the project. • Improved ability to easily find archived information quickly. • Reduced need for storage space for documentation at the end of

	the project
At least two thirds of all users found the following to be substantial benefits they had experienced:	<ul style="list-style-type: none"> • Less confusion over which version of any given document is the current one. • Greater confidence that everyone is working with the same version of a document. • Enabling geographically dispersed teams to work together on a project much more effectively. • Making it easier to find and retrieve the right document. • Providing a better & more complete archive of Health & Safety information at the hand-over stage.

The NCCTP research indicates that accessibility of documentation, accountability, and reduction in costs of storage and distribution are key benefits of project extranets. Other sources also state this as a key benefit. “The expensive task of sending or more likely couriering documents from, say the project architect, to all the members of the project team, often whether they need it or not, can be done away with, with the job of printing the relevant material moved across to the person or company actually wanting to use it.” (Middelbow 2001) Therefore, extranets can be viewed as a more sustainable approach as documents are stored electronically and only printed if required. “All the interviewees acknowledged that an early return on investment could be obtained through cost savings achieved on information distribution and sharing.” (Wong 2007) Therefore, extranets provide a more sustainable but also cost effective solution, thereby improving efficiency compared with traditional processes.

Evidence from the literature also shows that end users find the knowledge that they are using the latest up to date data to be a benefit (NCCTP 2006). “It ensures that all members of the project team have access to the most up to date versions of the various project documents. (Middelbow 2001) This means that traditional mistakes generated from someone working from an old document or drawing are in theory removed or at the very least reduced.” By reducing the amount of mistakes, it is needless to say that the amount of disputes will also be reduced. Simon Middelbow also says, “Project collaboration extranets have the opportunity to significantly reduce the opportunity for mistakes and disputes, the biggest causes of waste and inefficiency in construction.” Therefore, it can be said that extranets increase efficiency on construction projects.

Chee H. Wong’s research found “the key motivation factors for internet and extranet (IE) investment include: management enthusiasm to be at the forefront of IE uptake; process efficiencies across geographically-dispersed teams and project partners; reduction in the cost of learning and knowledge acquisition; and improved internal communication and information flows.”(Wong 2007) Management enthusiasm is stated as a key motivating factor. This research found that many of the respondents stated that management reluctance to employ extranets was a key barrier. Therefore, it is vital that the company’s management are supportive of implementing these systems in order for them to be effectively adopted. Chee H. Wong’s research also shows that communication is a key benefit. Good communication also has associated benefits such as improved team relationships. “Electronic data management technologies create an opportunity to simplify and streamline communication and interdepartmental coordination, thus supporting new modes of teamwork and in many instances total process reengineering (Ahuja, Yang and Shankar 2009). As well as improving team relationships extranets could be used as a marketing tool. “The advantage of using extranet as a marketing tool to improve the relationship with potential clients and customers was clearly demonstrated.” (Wong 2007)

Research by Ahuja, Fontenot and Blalock found richer information to aid decision making, project information obtained quicker, improved communication, closer relationships, improved information flow, and greater management control to be some of the benefits of extranets. They also highlighted other intangible benefits associated with project extranets, such as greater certainty of outcome in terms of cost and time, less risk of disputes due to reduced errors, greater collaboration across project teams, and less-wasted effort in the construction process. (Ahuja, Fontenot and Blalock 2009)

9 BARRIERS

The implementation issues surrounding extranets can be divided into three categories Technical, human and organisational (Pekerikli 2010; Mitchell undated). The technical issues can be categorised under the six major principles that are namely, interoperability, change management, the user interface, reliability, the cost and the infrastructure support. Human issues can be classified under six groups: ergonomics-human-system interaction, threat to social interaction, loss of power from knowledge and expertise, surveillance threat, health and safety restrictions, reduction of efficiency.

Organisational issues can be classified under five categories: existing organisational culture, risk to existing practices, wider organisational setting, legal challenges, distribution of costs and benefits.

One barrier to the use of extranets on a construction project is that extranets can be expensive and may potentially waste time on a project if they are not used properly. "If you don't use them effectively, they can be expensive time wasters." (Taylor 1997). This is especially true for small projects as extranets are expensive and implementing them on small projects may not be worth it, as the cost would probably outweigh the benefit. Also all the people in the team should use them properly as it would be a major inefficiency if it were available but not used to its full potential. "...the industry seems slow to respond. This is particularly so for the use of Information Communication Technology (ICT) in small- and medium-sized firms, both within an organisation and for communication with the project teams" (Wong 2007). In addition "In spite of assurances from IS managers, many company executives don't believe that the business information channelled through the system is secure and protected against interception or modification." (Bullock et al. 1997). Much of the documentation being transferred between parties is confidential; therefore, users need to be assured that it is secure.

Some feel that "Extranet implementation success occurs only when a hub company has the clout to force its trading partners to use its extranet." (Taylor 1997) Although it would be best to always use the same extranet system, as it would save on training costs etc., it is not necessary that each project use the same system. As extranets are web based each project could use different systems.

Lack of technical technology and managerial capacity, lack of awareness and understanding of technology, lack of human resources, comprehensive legal framework, lack of confidence and trust in new technologies are some barriers for extranet acceptance and adoption by small and medium sized companies. Some small and medium sized companies occupy small, clearly defined niche markets, sometimes entirely local and do not need the technology for their business. However, lack of resource and knowledge, the skill levels of businesses operators, lack of trust and reorganisation of the potential to improve business and knowledge, the effort and costs of adaption and lack of understanding of realisable benefits are the main barriers for them adopting the technology. (Donyavi 2011)

Organisations will need to evaluate whether extranets are a benefit to them overall before they commit to investing both money and time in them. They will need to evaluate the system and technology capability, not only upon usability but also through a balance assessment of several factors. For example, how useful the system will be, whether they think it is suitable or they would like to use it and how much it will cost, both in financial terms and in terms of personnel, social and organisational consequences (Shackel 1991).

Table 3: The paradigm of usability and related concepts. Modified from (Shackel 1991)

Utility +	Will it do what it is needed functionally?
Usability +	Will the users actually work it successfully?
Likeability	Will the users feel it is suitable?
Must be balanced in a trade-off against	
Cost	Where are the capital and running cost? What are the social and organisational consequences?
To arrive at a decision about	
Acceptability	On balance the best possible alternative for purchase

So the question is will extranet do what is needed functionally, according to the benefits of extranets we know that the systems are capable in terms of functionality; also will the users actually work it

successfully? According to this study, the companies that use extranets and work with the systems are quite happy and they state they intend to increase use in the future; therefore, organisations are able to use the systems successfully once they have overcome the barriers of employing extranets. The cost of employing extranets was a major barrier and concern for the interviewees. Therefore firms that can not overcome this barrier will not find the system acceptable as was the case with most of the firms interviewed; however if these barriers are overcome and organisations have used extranets, they feel that they prefer them to the traditional processes and that the use will grow in the future.

10 FINDINGS FROM THE RESEARCH INTERVIEWS

Most of the interviewees for this project felt that extranets have the potential to improve traditional processes in the construction industry.

Interviewees that use extranets stated that they had used them on around 30% of projects in the last three years. They said they prefer using extranets to the traditional methods of communication and they believe that the use of project extranets will increase in the next few years.

10.1 The benefits of extranets

Interviewees who used extranets considered that their use created a competitive advantage for their company, particularly through improved communication. They identified a number of benefits including:

- speed of communication with the project team,
- better relationships with the project team
- minimisation of errors, as they are always working with the latest information.

10.2 Barriers to extranets

The majority of firms interviewed still did not utilise extranets, suggesting that their use in the industry is still very low. Many firms whilst recognising the benefits that extranets can bring are still experiencing barriers to using them. The following key barriers are identified:

1. lack of knowledge
2. security concerns
3. expense of the systems
4. management reluctant to employ extranets
5. clients unwilling to use extranets
6. training costs
7. too many different systems used by different clients

These are listed in order of importance based on number of respondents stating this as a reason for not using extranets. Interviewees stated lack of knowledge about extranets as “a major barrier” as they felt especially smaller companies were unaware of what extranets are and how to implement them.

Most of the interviewees stated security as a primary concern for companies “Information is one of the most important factor in our company. We need to be sure that all of our company information is secure when we save it or transfer it” Therefore, users need to be assured that the extranet will provide them with security of information. However, some of the interviewees, although concerned about security felt that at the moment a lot of information is transferred via email, therefore extranets are an equal if not more secure method of data transfer. “I don’t see security as an issue as we use email etc. to transfer information at the moment, so a hacker could get it anyway.”

The expense of the system was stated as another important barrier “We have to finish the project, to get the money from the client, pay to our people and for the company expenses; we need to think about extranets when we have enough capital and are strongly sure of the return of our investment; this system now works for us.” Companies are happy with using their “tried and tested” processes and will need to be assured of the tangible benefits of extranets. The interviewees felt that not only the cost of the actual system, but also the expense of training staff and the time taken for training which takes staff away from productive work, mean that companies are reluctant to employing extranets.

Interviewees also stated that management may be reluctant to employ extranet because of the expense, but also because they do not want to take a risk, they feel that the systems they have in place work, therefore they are happy to carry on using them. The interviews also showed that in some cases the

employees would like to use extranets as they can see the benefits, but the management are reluctant to employ them, mainly due to the expense and time issues.

A number of interviewees also stated that clients are unwilling to use extranets. It is imperative that the clients support the use of the extranet, as they are the ones usually paying for the system. However, you need to explain to clients that spending money on extranets will be beneficial; however, this is difficult as many of the benefits are intangible. (Mitchell undated)

A few of the interviewees stated training costs and too many different systems being used by different clients as barriers. As mentioned above with expense of the systems, some of the interviewees felt that having to take staff away from their productive day-to-day activities for training was a barrier. In addition, having to be trained on different systems for different clients was seen as a further barrier, as this means more time away from productive activities.

11 CONCLUSIONS

A construction project requires communication between a number of different organisations each with different IT systems. Project extranets allow all these organisations to share and store data in an IT system that is compatible with all the organisations systems and allows easy access and storage of data.

This scoping study indicates that despite the acknowledged advantages of extranets and developments in the technology over the last 10 years, these systems are still not being widely used in the construction industry. Extranets can increase business efficiency in a number of ways and key benefits include accessibility of documentation, accountability, reduction in costs of storage and distribution and having the most up to date data available. Yet, as envisaged, most of the of contractor and house builder companies interviewed did not utilise extranets and those that did estimated they only used them on about 30% of projects in the last three years.

Barriers to the use of extranets identified by the research include lack of knowledge, security concerns, expense of the systems, management reluctance to employ extranets, clients unwilling to use extranets, training costs and too many different systems used by different clients.

However, this research also found that the interviewees who use extranets believe that their firm gained competitive advantage and they anticipated their use will increase in the next few years, in preference to traditional methods of communication.

This study provides a good grounding for the further study across the wider industry, including clients, consultants and larger contractor firms. The researchers believe that the following questions would benefit from being addressed as part of a further study:

- What is the cost of entry threshold for the introduction of extranets by firms?
- Given the indication that firms using extranets do not use them on all projects, what are the characteristics of projects on which extranets are used?
- Given that lack of skills is a barrier, what can the education system do to help facilitate the introduction of the technology more widely?

The researchers propose that a wider study would be undertaken using an online questionnaire to provide quantitative data about the use of extranets in the industry, with the potential for follow-up interviews to explore issues of cause and effect in more detail. The questionnaire would be targeted at senior staff and professionals working for clients, consultants and contractors.

While the researchers found that there were difficulties persuading firms to take part in the study during a period when they are focusing on fee earning work, they believe that a further study that could inform the education sector could benefit the industry by up-skilling workers as the economy improves.

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