

Theme:

Title:

The latest developments in communications and e-commerce – IT barometer in 3 Nordic countries

Author(s):

Rob Howard, Arto Kiviniemi, Olle Samuelson

Institution(s):

BYG.DTU Denmark, VTT Finland, KTH Sweden

E-mail(s):

rh@byg.dtu.dk ; arto.kiviniemi@vtt.fi; olle.samuelson@tyrens.se

Abstract:

Electronic communication and new forms of electronic commerce have been some of the fastest growing areas in information technology in construction. Denmark, Finland and Sweden are in the forefront of applying these technologies, and a recent repeat of the IT Barometer survey of the construction industry presents information from firms of: architects, property owners and managers, contractors, consulting engineers and others. This was first carried out in 1998. Comparisons are now made between levels of IT use then and in 2000/2001, and between the three countries involved.

The paper-based survey was developed at KTH in Sweden and the same questions were asked in Denmark and Finland. The survey includes: levels of staff, access to equipment and communications, current and future use of applications software, Intranets and Project Webs, e-commerce, future intentions, benefits and problems. The general aim is to measure progress in take up of technology and compare national differences.

The analysis indicates significant differences, with Denmark and Finland having a high level of staff access to PCs and e-mail and Finland making greater use of Project Webs and Intranets. The most interesting comparison is in attitudes to financial control systems, where Swedish and Danish companies place better financial control as a high priority, while it has dropped in importance in Finland. Swedish and Danish companies appear to have most of the CAD facilities they need, but in Finland this is still a priority for investment. A reduced proportion of drawing work is carried out manually by architects and engineers in all three countries, around 15 – 20% for Denmark and Sweden, while this has reduced in Finland from 34% to 6% in the last 3 years and, in Sweden, from 36 – 14%. E-commerce is most fully developed in Finland where over three quarters of companies have some experience of its use.

Keywords:

Survey, e-commerce, data exchange, project web, advantages of IT

Surveys on the use of Information Technology in construction are notoriously difficult to do in construction. Responses tend to be higher from those companies that make greater use of computers and communications. The 2001 IT barometer had the benefit of repeating a survey carried out three years previously, and it was developed in Sweden under the IT Bygg och Fastighet development programme and carried out through the Swedish national statistics office. The same questions were asked on paper questionnaires sent to Danish and Finnish companies in: architecture, property owners and managers, contractors, engineering consultants and materials suppliers. In Denmark the survey was linked to the Centre Contract on Building Classification [1] and some additional questions were asked on future plans for use of technology, awareness of new developments and use of classification systems.

The result of this work carried out in late 2000 in Sweden and in 2001 in Denmark and Finland, is a valuable comparison between the years 1998 and 2000/1, and between the construction industries of 3 Nordic countries. It was hoped that Norway would also carry out the same survey but this was not possible to arrange. The last IT barometer was used in several other countries including: Canada, Ireland, Saudi Arabia and South Africa. These and others are welcome to use the questions from the IT Bygg och Fastighet Website [2], and the CIB W78 group [3] would be interested to have more comparative data.



Methodology

Inevitably the methodologies and samples used in each country differed slightly, and the level of response was significantly higher in Sweden. Descriptions of the methodology used in each country are given below. The analysis has been carried out in as similar way as possible, by Swedish statistics initially using SPSS and weighting all the answers by the number of staff in each of the offices that responded. In Denmark, with fewer responding companies, the data for 1998 was analysed by company only. The results have been presented using Excel to group firms by types and size, and generate charts and tables that compare the data on a similar basis. In Sweden the results have been related to the whole construction industry and are valid to apply at this scale. In Denmark and Finland the results can only be said to apply to the particular sample selected and should not be taken to represent the construction industries of these countries as a whole.

The most valuable comparisons are between 1998 and 2000/1 since most of the same questions were asked of similar samples. These indicate the rate of growth of take up of IT systems during a period of great change. An interesting difference between the countries in that period is that both Finland and Sweden had major development projects on IT in building over that period, while Denmark's proposal for Det Digitale Byggeri [4] has yet to start. The authors of this paper would like to thank all those who helped with the surveys, those who supplied addresses, and those who responded and provided a valuable insight into use of IT, future intentions, problems and plans for investment.

Basis for the survey in Denmark

1000 companies were sent questionnaires as members of the following industry organisations:

- 250 Architects, members of the Praktiserende Arkitekters Råd, PAR
- 250 Building owners or managers. 100 members of the Danish Facilities management network, and 150 Kommunes, local authorities
- 250 Contractors. 100 larger members of Dansk Entreprenører. 150 smaller members of BYG
- 250 Consulting Engineers, members of the Foreningen af Rådgivende Ingeniører, FRI

Of these, 136 were returned, not a large proportion but higher than the response in 1998. The main difference from 1998 was that many more smaller consulting engineers responded, and that the property owners' and managers' responses were dominated by communes with large staffs, only a few of which are involved with building. The full report is available from the DTU web site [5].

Basis for the survey in Finland

In Finland the questionnaire was distributed by the industry organisations ATL (The Association of Finnish Architects Offices), SKOL (The Finnish Association of Consulting Firms), RTK (Confederation of Finnish Construction Industries) and Rakli (The Finnish Association of Building Owners and Construction Clients) to their members, and it was also available on the Vera Technology Programme web site [6] to any interested company. The exact number of sent questionnaires was not recorded, and hence the response rate could not be measured. In the previous questionnaire in 1998 880 questionnaires were sent and a total of 62 answers were returned, and the reply rate was 7%. In the 2001 questionnaire a total of 93 answers was returned, and the response rate can be estimated to be around 10%. This means that the results are not statistically significant, but even so the questionnaires of 1998 and 2001 can be compared because the method and response rates are similar. The significant difference is the higher ratio of contractors who responded to the questionnaire in 2001.

Basis for the survey in Sweden

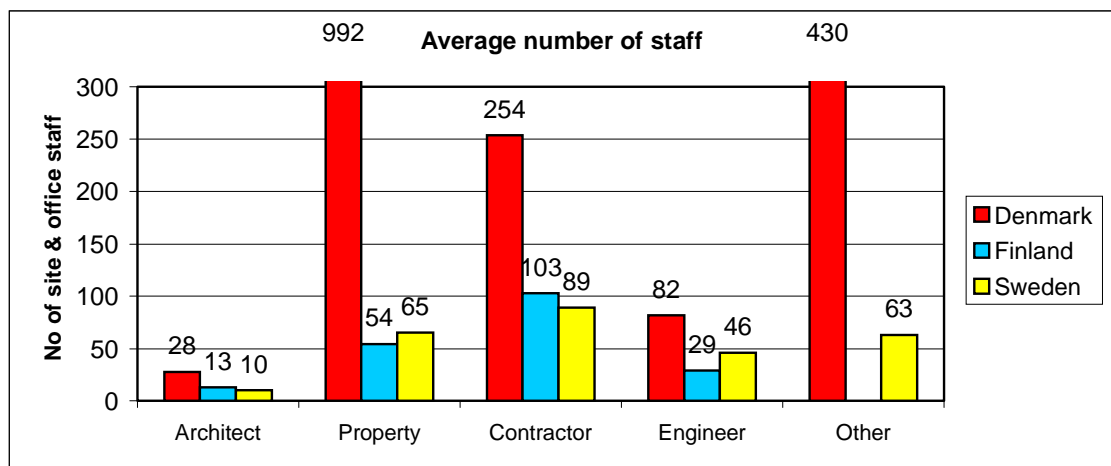
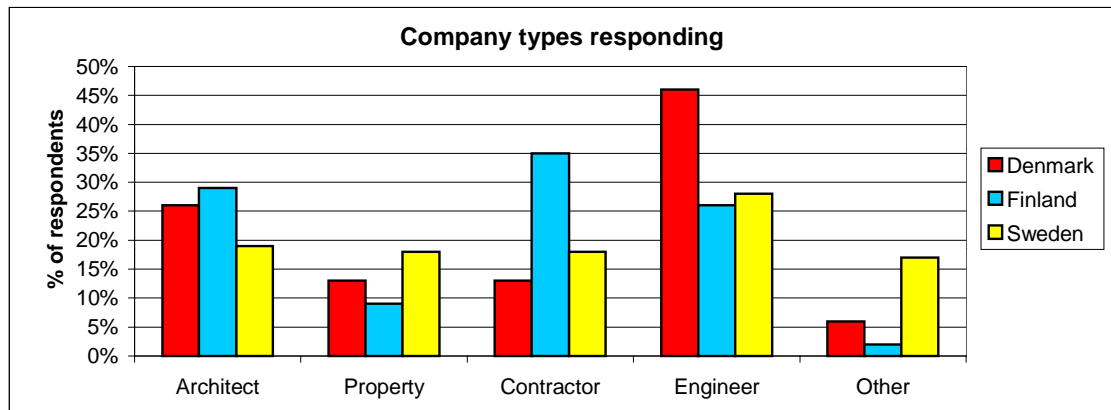
1316 companies were statistically chosen with help from Statistics Sweden (SCB). The method chosen was stratified free random selection and this resulted in 636 answers, which correspond to an answering rate of 49 %. The answers were divided into following types of companies:

*	Architects	245
*	Engineers	316
*	Contractors	320
*	Property managers	214
*	Others (Manufacturers/Trade)	221

The answers were weighted with regard to number of employees and type of company, so the result is representative of the whole industry. [7]

Number and size of companies responding in each country

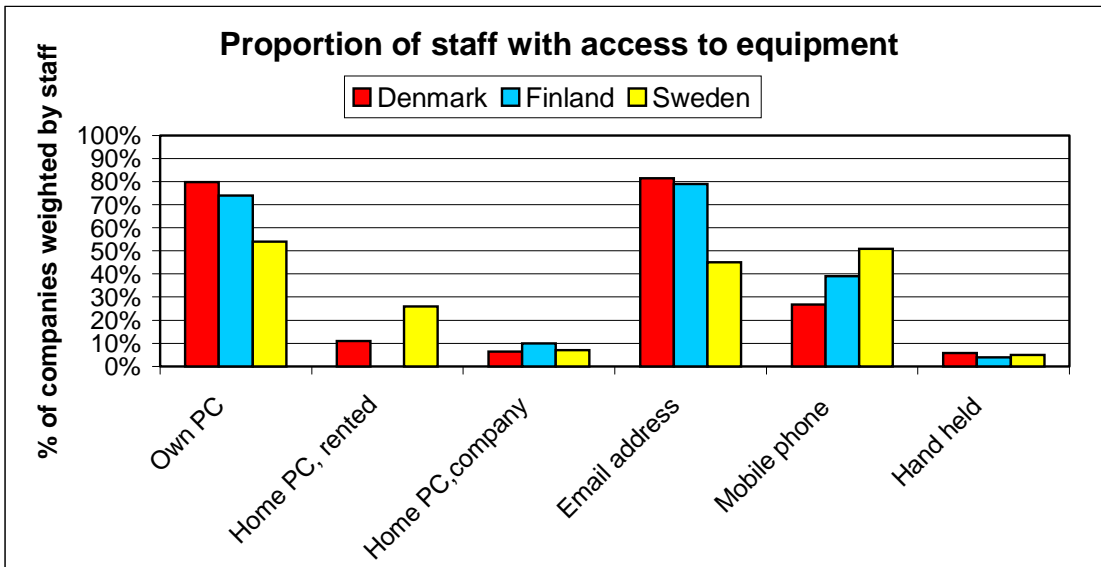
The results of the survey should be read in conjunction with the different proportions and sizes of each type of company responding in each country.



The 'other' companies include a small number of large product suppliers in Denmark but their data is not included in the analyses by company type that follow. Allowance should be made for the generally larger size of companies in Denmark when reading the comparisons. Although a range of all sizes of company was in the sample selected, the fact that larger companies responded in Denmark does not imply that all companies are larger. In property the communes with their large, non-building staff have a major effect.

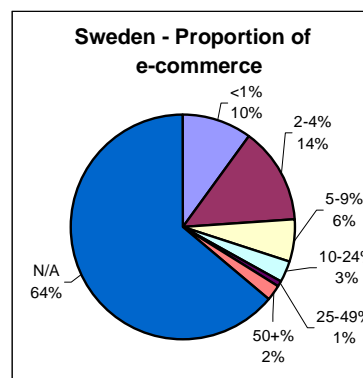
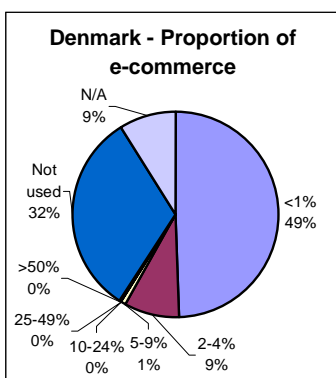
Proportion of staff with access to equipment

A major change since 1998 has been the penetration of IT equipment onto the desks of almost all office-based staff and many site staff. When the company responses are multiplied by the numbers of staff in each, it can be seen that there are PCs for almost all staff and that some also have PCs at home supplied by the company. Details of portable computers were not asked for. Email addresses are closely linked to PC availability, although the figures for Sweden appear to be low. Mobile phones are supplied to more staff by their companies in Sweden, and use of hand-held computers in all three countries is now starting.



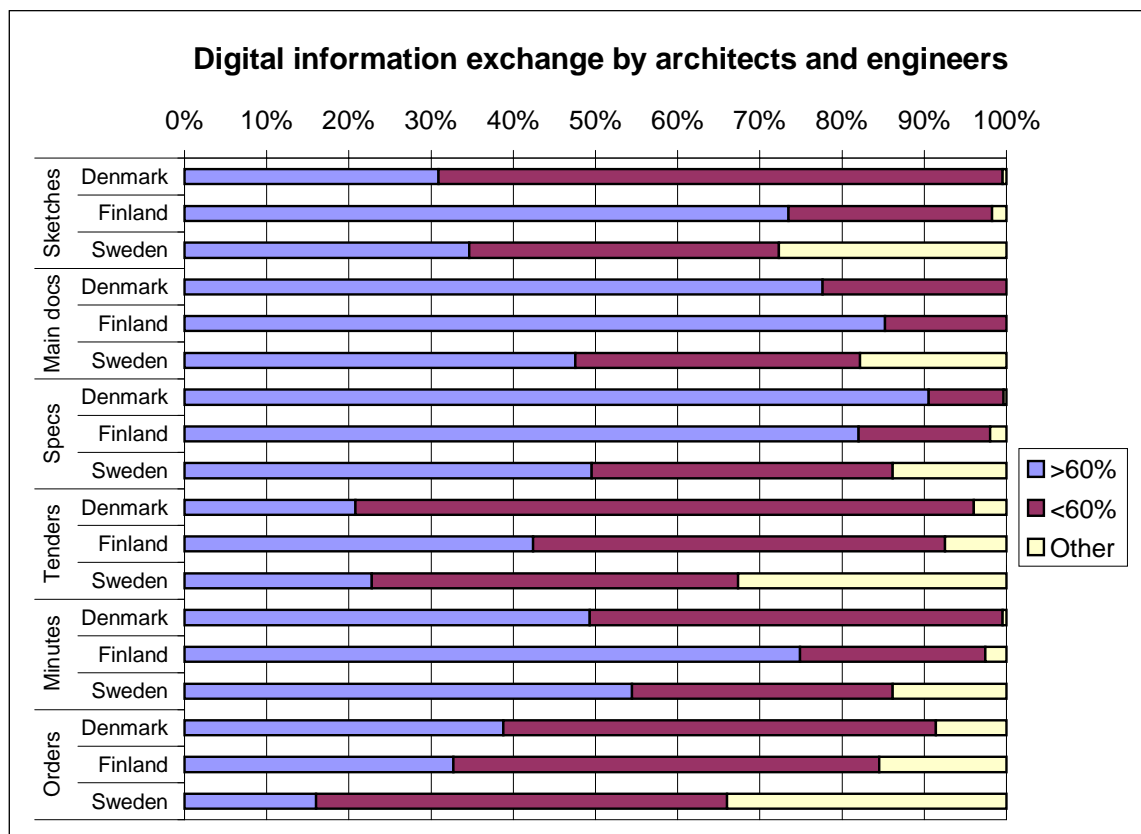
Proportion of business from e-commerce

Conducting business electronically is an important area for growth of IT systems. It was defined as buying or selling products or services by electronic means. There may be some confusion in the responses to 'N/A', not applicable – since e-commerce should be universally applicable, 'not used' and '<1%'. N/A in Sweden includes 'not used'. It is clear that greatest use is being made in Finland where less than one quarter of the companies, weighted by number of staff, have no experience of e-commerce, and 40% use it for 2-4% of their work. In Denmark about half use it for less than 1% of their work and this probably implies some exploration only. In Sweden 14% use it for 2-4% of their work and about two thirds report no experience or interest in e-commerce. In Denmark this figure is about 40% of companies weighted by staff numbers. The larger companies make much greater use of e-commerce.



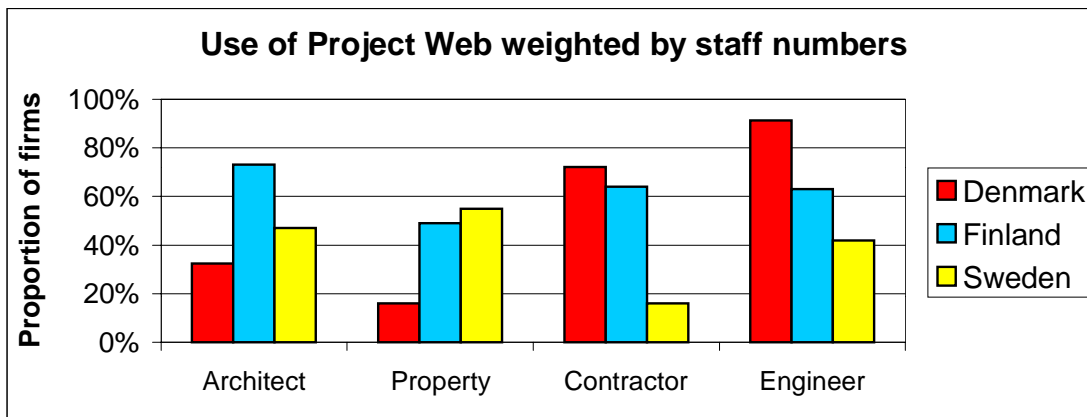
Proportion of data exchanged digitally

Much information is now being exchanged digitally, whether on office networks or, with project partners, via attachments to e-mail or project webs. For architects and engineers ketch designs are most widely exchanged in this form and Specifications, mainly produced digitally, are particularly highly exchanged in Denmark and Finland, as are main documents. Sketches and main documents appear to be less completely digitally exchanged in Sweden, although, in Finland, this question was divided into two categories. Other differences between the countries include the high level of exchange of tenders and meeting minutes in Finland.



Use of Project Web

Project Webs, otherwise known as Extranets, were defined as storing or retrieving data from a project homepage on the Internet. These are also used more by the larger companies, and their use by the few large companies in Denmark, weighted by their size, indicates more activity than would be found if analysed by company only, particularly for contractors. In Finland the architects are the most active users, while it is the property companies in Sweden. The general levels of experience seem high, but many companies may have only tried out this technology on a few projects and this does not indicate how widely Project Webs are used within each company, except in Finland where only 18% of the users responded that they use project webs in less than 10% of their projects, 65% reported the use being between 10 - 40%, and in the remaining 17% the use exceeded 40% of the projects, in 8% over 90%.



Trends in plans for investment

Priorities for future investment in IT depend upon both the need for new systems and whether they have already been acquired. CAD systems are now in wide use so they have reduced in priority as has the need to link to the Internet. Document handling is now the most urgent need in Denmark and Sweden, while this has decreased in Finland. Cost control has increased in importance in both Sweden and Finland but has declined in Denmark. Accounting systems and electronic trade are areas for growth in Denmark, but have lower priority in Finland, perhaps because there is greater use already in Finland. Product models and virtual reality are still at the bottom of the table, but product models are increasing their ranking in Finland, and are already in the sixth position on the list. Comparison between the two years is complicated because some of the topics were not included in 1998, and by analysis of the 2001 data weighted by staff numbers, whereas it was only analysed by company in 1998. N/A signifies that the question was not asked. Plans for investments still concentrate on administration rather than strategic use, with new business processes and VR not yet important to the companies.

Plans for investment Rank	Denmark			Sweden			Finland		
	2001	1998	Trend	2000	1998	Trend	2001	1998	Trend
Document handling	1	4		1	1		5	1	
Costing and cost control	11	5		2	5		1	5	
Project management	5	7		5	6		4	9=	
Accounting systems	2	2		3	3		10	3	
CAD	6	1		7	4		3	2	
Portable/mobile systems	4	N/A		4	8		8	7	
Project webs	7	N/A		10	N/A		2	N/A	
Electronic trading	3	N/A		6	7		11	9=	
Internet searches	10	3		8	2		7	4	
No plan to increase IT use	N/A	N/A		9	N/A		15	N/A	
Technical calculations	13	6		11	9		9	6	
Property information	8=	N/A		12	N/A		13	N/A	
New business models	8=	N/A		13	N/A		12	N/A	
Product models	12	8		14	11		6	8	
Virtual reality	14	N/A		15	10		14	11	

Trends in advantages of IT

Perceptions of where IT systems have produced advantages for companies are important for future investment and meeting business objectives. Faster access to information is consistently highly ranked as is better communications. Better quality of work has declined in importance in all three countries. Perhaps quality improvements had already been achieved between 1998 and 2001. Sharing information is seen as greatly improved particularly in Denmark and Finland. Better financial control has gained more advantage in Denmark and Sweden but gone down in Finland. Reduction of staff is not seen as an advantage in the companies. Again the method of analysis changed between the two survey years, in Denmark and Finland, from company, to company weighted by staff.

Advantages of IT	Rank	Denmark			Sweden			Finland		
		2001	1998	Trend	2000	1998	Trend	2001	1998	Trend
Sharing information	2	7		4	6		1	8		
Faster access to information	3	3		2	1		4	6		
Better communications	4	6		3	4		3	5		
Better financial control	1	5		1	5		8	3		
Handling a lot of data	6	4		5	7		5	3		
Satisfying customers	5	8		8	8		6	7		
Work done more quickly	11	1		6	3		2	1		
Better quality of work	7	2		7	2		7	2		
Working from home	8	9		9	9		9=	9		
Attraction to new staff	9	10		10	10		9=	11		
Developing new business	10	N/A		11	N/A		9=	N/A		
Reduction of staff	12	11		12	11		12	10		

Conclusions

The main problem with surveys of IT use is that there tends to be a higher level of response from companies that make greater use of IT. This is hard to avoid but the repetition of the IT barometer, by the same people and using mainly similar questions, provides valuable comparisons over time and between countries. The profiles of the respondents in each country vary quite widely, and the method of analysis is different in Sweden from that used in Denmark and Finland, and these factors should be taken into account when applying them to the whole construction industry of each country. Only the Swedish survey is representative of the whole national industry owing to the higher response level attained. Most of the analysis weighted the results according to the numbers of staff in each company responding. In Denmark this has meant that, for example, property owners represented mainly by local authorities where only a few of the staff relate to property, have had a high influence on some results.

Access to computers and e-mail is almost universal with office-based staff, although the results for Sweden appear lower than might be expected. E-commerce is quite widely defined but much experience has already been gained, with only one quarter of Finnish firms having no experience, while two-thirds of companies have no experience in the other two countries. Digital exchange of building data appears to be widely used among architects and engineers in Denmark and Finland. The types of data most frequently exchanged digitally are: sketch designs, main design documents and specifications. Again Sweden seems low but this may be due to the wider response there including more of the less committed IT users. Project Web was one particular form of digital exchange using project extranets, which was studied, and its use varies between the different groups with engineers and contractors making the highest use in Denmark, and architects in Finland.

Comparisons between the 1998 and 2000/1 surveys indicate trends in priorities for investment in IT systems and in the advantages perceived from them. Costing and cost control systems have increased in priority in Sweden and Finland but declined in Denmark, and this may indicate a difference in priorities and a reason why productivity has not increased in Danish building. CAD systems are declining in need for investment, probably because the companies have already invested in these. In a similar way, Internet facilities are not a priority for future investment because they are already installed. Document handling, project management and portable systems are each increasing in importance in one of the countries. The comparative ranking of the advantages seen from IT shows financial control increasing in importance in Denmark and Sweden but declining in Finland. Other advantages, such as quicker and better quality work may have already been achieved, hence their reduced importance. Sharing of information is ranked higher overall and is a result of the wide availability of the Internet and its use for Project Webs.

This paper has been limited in length and it is possible only to present a few of the results and their analysis by type and size of company. Much more data is available in the reports of each national survey and further analyses could be carried out by the institutions responsible. Others who wish to repeat the survey in their countries, as was done in 1998, can access the survey questionnaire on the IT Bygg och Fastighet [2] or BYG.DTU [8] websites. Sharing of this data is done through the CIB W078 organisation [3] and those repeating the survey should link their results to this site. It is dangerous to draw sweeping conclusions even from surveys conducted in such a coordinated way as the IT barometer. Hard measurement of the real benefits of IT and its use in construction, and adoption of new technologies, would be much more significant in changing building processes, and the return from these can only be seen in the longer term.

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