A STUDY OF THE USE OF INFORMATION TECHNOLOGY (IT)
IN THE REPUBLIC OF IRELAND CONSTRUCTION SECTOR

K. Thomas

ABSTRACT

The current use of Information Technology (IT) by the leading Architectural, Consulting Engineering, Quantity Surveying and Contracting firms in the Republic of Ireland is assessed. Estimates of the future use of IT by these firms and the Irish construction sector in general are also included. The results are based on a wide ranging questionnaire survey conducted amongst the top 50 in each of the four sub-sectors. These results are presented under the headings 'Computer Hardware and Software', 'Communications', 'Management of IT', 'Difficulties with IT', 'Strategy and IT' and 'General influence of IT on the Irish construction sector'. Some comparisons with the results from other similar surveys in other countries are made. The survey reveals that although there are some similarities in the extent to which each of the sub-sectors are currently using IT and how they intend to use IT in the future, there are also some significant differences.

INTRODUCTION

The value of the construction sector in the Republic of Ireland was estimated at IR£5.7 billion in 1996 which represented 13% of GDP (Department of the Environment, 1997). This sector employs approximately 120,000 persons directly and indirectly and this represents about 9% of the workforce. Construction is therefore extremely important to the Irish economy.

The use of Information Technology (IT) in construction around the world has increased greatly in recent years. This is also probably true for the Irish construction sector but specific information regarding the extent and details of this use is unclear. Given the importance of the construction sector to the Irish economy and its increasing use of IT there is a need for research into this subject.

This paper reports on a wide ranging study of IT use in the Irish construction sector by the leading firms in four key sub-sectors; Architectural, Consulting Engineering, Quantity Surveying and Contracting. The study, carried out in April 1998, consisted of a questionnaire survey with the following objectives:

1. To discover the extent of their current IT use;
2. To determine the level of their strategic approach to IT;
3. To estimate their potential IT use and that of the construction sector in general.

Specific information technologies that were included in this study were computers (number, type), software (design, planning, estimating, financial, general administration, operating systems, bespoke), fax machines, mobile phones, networks, world wide web and e-mail. For the purposes of this paper however Keen's (1995) definition of IT as 'the combination of computers, telecommunications and information resources' is used. Not only does it recognise the key technologies involved, i.e. computing and telecommunications, but also that information resources must be included.

LIMITATIONS TO THE SURVEY

The survey was confined to four of the traditional sub-sectors of the Irish construction sector. Other sub-sectors such as suppliers and clients were not included in this survey. The leading 50 firms in each of the four sub-sectors were targeted and this was done on the following basis:

1. *Architecture* - the top 50 firms ranked by staff numbers from a total of 250, based in the Rep. of Ireland and registered with the Royal Institute of the Architects of Ireland (RIAI);
2. *Consulting Engineering* - the top 50 firms ranked by staff numbers from a total of 103, based in the Rep. of Ireland and registered with the Association of Consulting Engineers of Ireland (ACEI);
3. *Quantity Surveying* - the top 50 firms ranked mainly by number of employees who are Chartered Surveyors from a total of 106, based in the Rep. of Ireland and registered with the Society of Chartered Surveyors (SCS);
4. *Contracting* - the top 50 firms ranked by turnover from a total of 3500, based in the Rep. of Ireland and registered with the Construction Industry Federation (CIF).

The author notes that it is possible that there are Irish firms that were not included in the survey but are exploiting IT to a greater extent than some of those that were included. This is particularly likely to be the

case in the Architecture and Consulting Engineering sub-sectors where anecdotal evidence would suggest that some small firms are relatively advanced in their use of IT. The results therefore do not necessarily reflect the general use of IT in any of the sub-sectors studied or of the construction sector as a whole. The do however show how the current leaders in each of the four sub-sectors are using and are likely to use IT.

The fact that there may be a number of firms who are involved in architecture, consulting engineering, quantity surveying and contracting activities but are not registered with any of the recognised representative bodies (i.e. RIAI, ACEI, SCS and CIF) is also acknowledged. Also none of the public sector bodies involved in the management, design and construction of public projects (e.g. the National Roads Authority, County Councils, Corporations) were included in this survey.

THE QUESTIONNAIRE DESIGN

The questionnaire was designed to achieve the stated objectives and to encourage a high response rate. Ideas on the type of questions to be asked and the associated methods were generated and developed over a three month period. A draft version of the survey was piloted with relevant individuals in each of the four sub-sectors. Many of the comments and suggested amendments were incorporated in the final version of the questionnaire. Prior to posting the questionnaire, a phone-call was made to each firm in order to identify the most senior person in the company with responsibility for IT. In some firms this person was known as the IT Manager but in the majority of cases this person had other responsibilities apart from IT.

RESPONSE TO THE QUESTIONNAIRE

The response rate for each of the targeted sub-sectors was as follows:

CONSTRUCTION SUB-SECTOR	CODE	NO. OF REPLIES	RESPONSE RATE
Architecture	ARCH	37	74%
Consulting Engineering	ENG	33	66%
Quantity Surveying	QS	38	76%
Contracting	CON	33	66%
TOTAL		141	70.5%

Figure 1: Response Rate

The overall response rate of 70.5% was regarded as satisfactory.

SURVEY RESULTS AND ANALYSIS

There were 94 questions in total included in the questionnaire. The results of the answers to the majority of these questions are discussed below. A number of charts and tables have been included to clarify and emphasise some of the more complex and important results. In these charts and tables the individual results for each of the sub-sectors of Architecture, Consulting Engineering, Quantity Surveying and Contracting are shown as percentages using the codes **ARCH**, **ENG**, **QS** and **CON** respectively. The overall average percentage for the four sub-sectors is shown as **Ave**. Some respondents did not answer some of the questions and where this has occurred it is indicated as a percentage in the chart or table as **NR**.

The results have been classified under the following headings:
a) Computer hardware and software
b) Communications
c) Management of IT
d) Difficulties with IT
e) Strategy and IT
f) General influence of IT on the Irish construction sector

a)   Computer Hardware and Software

The questions and the associated results in this section are related to the number and type of computers in use, the range of commercially available software in use and the extent of development and use of bespoke software. The ratios of numbers of computers to numbers of staff are shown in Figure 2 and the most striking result is that of the Contracting sub-sector (0.17) as it is substantially lower than that of the other three sub-sectors. While it could have been predicted that Contracting firms would have a lower ratio, the difference is greater than anticipated.

The replies to other questions relating to the type of computers in use would indicate that desktop PCs are the overwhelming choice of the Architectural, Consulting Engineering and Quantity Surveying sub-sectors while the Contracting sub-sector replies indicated that 63% are using mainframes to some extent. Results regarding portable/laptop computers also highlight a difference between the Contracting and other sub-sectors in that a significantly higher proportion of the Contracting sub-sector stated that they are using these type of computers. This would confirm the relative importance of computer mobility to the Contracting sub-sector in comparison with the other three sub-sectors that are largely office based.
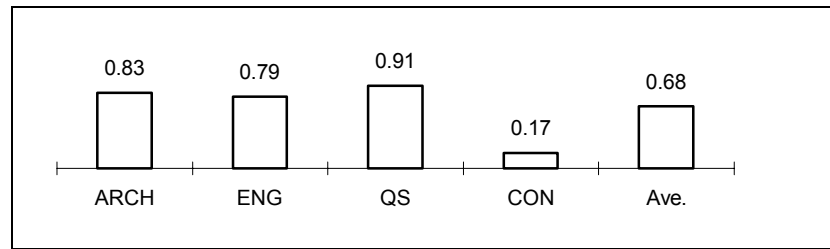
Figure 2:   Ratio of numbers of computers to numbers of staff

Commercially Available software was examined under the four headings of 'Design', 'Project Planning, Estimating and Finance', 'General Administration/Business' and 'Operating Systems'. Only the commercially available design software that register in excess of 10% in any individual sub-sector are shown in Figure 3 from a total of 49 different software products referred to in the 'Design' category. AutoCAD dominates, particularly in the Consulting Engineering sub-sector where all of the firms said they were using this software. Information regarding the precise version or type of AutoCAD in use was not obtained. Oasys and Strap are the most popular structural engineering design software. Cymap Cadlink and Hevacomp M&E are the most popular mechanical and electrical engineering design software.

Only the commercially available planning and estimating software registering in excess of 10% in any individual sub-sector are shown in Figure 4 from a total of 33 different software products in the 'Project Planning, Estimating and Finance' category. Microsoft Project is the most popular project planning software, probably due to the fact that it is relatively inexpensive and is similar in appearance and use to other Microsoft software products. Buildsoft is the most popular estimating software used by the Quantity Surveying and Contracting sub-sectors.

Only the commercially available general business software that registered in excess of 5% in any individual sub-sector are shown in Figure 5, from a total of 26 different software products. As expected Microsoft Office dominates the 'General Administration/Business' category. Microsoft also dominates the 'Operating Systems' category as expected with Windows 95 [Figure 6]. It is interesting to note that a significant number of firms are still using Microsoft Windows 3.1 and that a majority of respondents are using more than one Operating System. The significant number of Architectural respondents that use Mac-Os (27%) indicates the preference of many in this sub-sector to use Apple Mackintosh hardware.

The subject of bespoke software was included on the basis of a comment by Brian Atkin at an IT seminar in London (1998) that in his experience the best users of IT in the construction use bespoke software. There is a large variation in Yes replies with Engineering and Contracting sub-sectors relatively high at 52% and 42% respectively compared with those of the Architectural and Quantity Surveying sub-sectors relatively low at 8% and 10% respectively. It is interesting to note that on average companies are less inclined to create or develop bespoke software in the future with Quantity Surveying the only sub-sector of the four where there is an increase anticipated.

SOFTWARE	ARCH %	ENG%	QS%	CON%	Ave.%
AutoCAD	62	100	18	52	58
Microstation	30	24	0	14	17
3D-Studio	19	12	0	0	8
Mini CAD	22	0	0	0	6
CADS	3	15	0	0	5
ENCAD	0	12	0	0	3
Adobe Photoshop	11	0	0	0	3
Oasys	0	21	0	0	5
Strap	3	15	0	0	5
Cymap Cadlink	0	15	0	3	5
Hevacomp M&E	0	15	0	3	5
ENFRAM	0	12	0	0	3

Figure 3:   Commercially available Design Software currently in use

SOFTWARE	ARCH %	ENG%	QS%	CON%	Ave.%
MS-Project	41	49	29	49	41
PowerProject	0	3	11	30	11
Primavera	0	6	3	12	5
Buildsoft	3	3	47	39	23
Manifest	0	0	0	12	3
Masterbill	0	0	11	0	3

Figure 4:   Commercially available Project Planning, Estimating and Finance Software currently in use

SOFTWARE	ARCH%	ENG%	QS%	CON%	Ave.%
MS-Office	92	91	76	94	88
Lotus	8	24	29	15	19
Corel	24	15	8	3	13
Quickpay	8	6	8	0	6

Figure 5:   Commercially available General Administration/Business Software currently in use

SOFTWARE	ARCH%	ENG%	QS%	CON%	Ave.%
MS-Windows 95	62	91	90	85	82
MS-Windows 3.1	16	55	40	49	39
MS-Windows NT	41	30	18	24	28
UNIX	3	9	3	39	13
Mac-Os	27	0	0	0	7

Figure 6:   Commercially available Operating Systems currently in use

b)   Communications

The questions and answers in this section are mainly related to the internal and external communications by firms in the four sub-sectors. Methods of communication studied include fax, mobile phone, networks, world wide web (www) and e-mail. The extent of use of CD's is also considered.

As expected all respondents confirmed that they use fax machines. Confirmation that mobile phones are widely used (90-100%) within the four sub-sectors was also received. The range of questions relating to networking that were included in the survey yielded some interesting results. For example an Average of 56% across all four sub-sectors stated that all computers within their firms are networked with the Architectural sub-sector at an impressive 73%. Also in relation to external networks or computer links with other firms the vast majority (Average of 84%) replied that are not directly connected.

An Average of 84% stated that they were connected to the www. This figure was higher than expected although it was unclear if all or just a proportion of the computers and employees within these firms had access to the www. Anecdotal evidence would suggest that many firms are concerned about allowing all employees uncontrolled access to this facility as it may prove to be a distraction rather than of benefit to the employees' work related activities. The number of firms that have pages on the www was also higher than expected [Figure 10], particularly in the Consulting Engineering sub-sector. The responses of those companies that do not have a homepage on the www would indicate that the Average across the four sub-sectors will rise from 19% to 33% by the end of 1998 and to 42% by the end of 1999. Possibly the most interesting reply to this question was those who indicated they would never do so (Average 13%). It is likely that many of these replies were given on the basis that the relevant firms did not envisage a sufficient benefit from having a homepage but one particular reply stated that they thought they were prevented from doing so by the code of conduct of their professional institution.

CD-ROM's appear to be used to a greater extent by the design sub-sectors, particularly Consulting Engineering (82%). The relatively low figure for Quantity Surveying of 26% may suggest that the extent of appropriate CD-ROMs for this sub-sector is limited. Two respondents (1 Architectural firm and 1 Contracting firm) stated that they have produced a CD-ROM to advertise their services. When asked about using CD's to store information the Consulting Engineering sub-sector indicated the highest level of the four with 42% and Quantity Surveying the lowest with 10%. The probability that construction-related information will be increasingly available on the www however may well lead to a decrease in the use of CD-ROM's.

With regard to e-mail the Architectural and Consulting Engineering sub-sectors are leading the way as expected [Figure 8]. It must be noted however that within those firms in each of the four sub-sectors that do have e-mail facilities there is a significant number of individuals who have access to e-mail but do not use the facility. It is interesting to note that all those who do not have e-mail facilities stated that they intend to do so at some point the future. Currently e-mail is being primarily used for the distribution of

documentation (including drawings) and the sending of simple or informal messages [Figure 9]. The use of e-mail to purchase goods or services is relatively low, particularly in the Quantity Surveying and Contracting sub-sectors, but this is likely to increase significantly in the future.
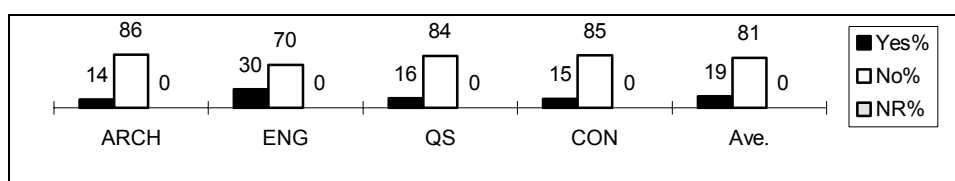

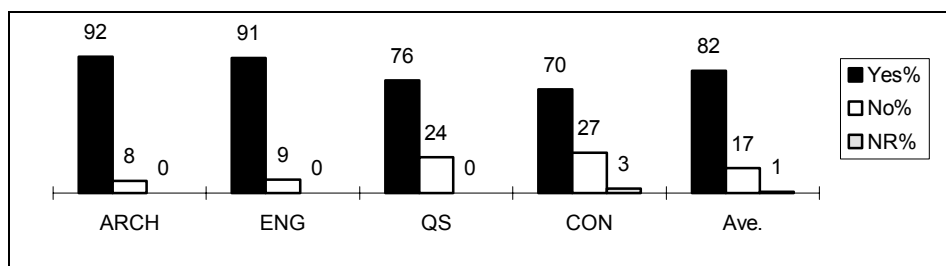
Figure 7: Does your company have a page on the www ?

Figure 8: Does your company use e-mail ?

PURPOSE OF E-MAIL	ARCH%	ENG%	QS%	CON%	Ave.%
Distribution of documentation (incl. Drawings) to other companies	70	85	61	39	64
Sending simple/informal messages	54	67	63	61	61
Sending formal messages	49	48	40	36	43
Distribution of documentation (incl. Drawings) within the company	16	27	26	24	23
Purchasing	19	12	0	6	9
Distributing software	11	3	0	6	5
NR	19	12	26	30	21

Figure 9: For what purpose is e-mail used ?

c)   **Management of IT**

The questions and answers in this section are mainly related to how IT is managed by firms in the four sub-sectors. The extent of use of external consultants and specialists and expenditure on IT are also examined. The majority of respondents in each of the four sub-sectors do not have anyone who is specifically employed to deal with their IT systems. The Average result of 15% stating that they have a separate IT department or section would suggest that IT is mainly managed by individuals or groups of individuals as part of their role in their companies.

Questions regarding the use of external consultants to advise on IT matters and external specialists to install IT provided some contrasting results. For example 0% and 24% of the Consulting Engineering and

Quantity Surveying sub-sectors respectively stated that they always use external consultants to advise on IT matters. Also the Average figure of 36% indicating that companies always use external specialists to install IT is significantly higher than the Average figure of 11% indicating that companies always use external consultants to advise on IT matters. This would suggest a degree of confidence within firms to identify and decide what IT is required but less confidence about installing the chosen solutions. The profile of results to the question of using external specialists to maintain IT is similar to that regarding installation. The one main exception to this however is the significant drop in Architectural sub-sector from 46% to 22% who would always use external specialists to install and maintain IT respectively.

Questions relating to expenditure on IT produced results in line with expectations. The Contracting sub-sector for example, where the annual turnover would be substantially greater than that of the other three sub-sectors, spend a relatively smaller percentage on IT with the majority (67%) replying that they spend less than 0.5% of their annual turnover. Similar rates of expenditure were expected to be spent in five years time on IT as is being spent currently in each sub-sector.

d)   Difficulties with IT

This section addresses the commonly held belief that existing IT is not being exploited to its full potential and attempts to identify the reasons why this may be true. Various sources over the years in different parts of the world have referred to many of the technical and non-technical reasons hindering the use of IT in construction. For example some of the difficulties with the implementation of IT in construction were referred to by the Department of the Environment in the UK (1995), primarily those that relate to the construction environment. Grilo et al (1996) identify a number of factors hindering electronic collaboration, with particular emphasis on the relationship between construction firms and suppliers. Tucker and Mohamed (1996) also discuss a number of the non-technical barriers to the implementation of IT. A comprehensive list of these previously identified reasons together with other reasons identified by the authors of this paper was included as part of the questionnaire.

Regarding the general question of firms using their existing IT to its full potential a significant majority (Average 68%) believe that they are not doing so. In reality it is probably true that IT is never used to its full potential but most firms can do more to approach this state and thereby benefit themselves and the construction sector as a whole. Identifying and overcoming hindrances to the use of IT is vitally important part of that process and it is very interesting to note that the overall trend of responses in relation to these hindrances would indicate that Human reasons are the most common followed by Technological, Financial and Environmental reasons respectively [Figure 10]. The reasons shown are those that were included on the questionnaire survey but others that were suggested by a individual firms included; lack of time to develop systems, training etc.; poor support or service from IT providers; limited range of available software for specific tasks; lack of industry standards; lack of guidance from relevant Institutions or representative bodies; difficulties in future proofing; and lack of available ISDN facility. Three respondents specifically stated that there was nothing hindering the use of IT in their firms.

TECHNOLOGICAL REASONS	ARCH%	ENG %	QS%	CON%	Ave.%
Integration / compatibility problems	35	27	34	64	40
Rapid changes in technology	30	49	26	36	35
Software problems	19	27	13	18	19
Reliability / breakdown problems	30	15	5	9	15
Hardware problems	11	9	5	15	10
Security not guaranteed	8	3	11	9	8

HUMAN REASONS	ARCH%	ENG %	QS%	CON%	Ave.%
Inadequate training	57	39	45	33	44
Lack of knowledge/awareness of available IT	38	33	34	55	40
Fear/mistrust of technology	16	24	18	39	24
Poor management	16	18	18	15	17
Poor teamwork	5	9	5	6	6
Poor leadership	11	6	0	3	5

FINANCIAL REASONS	ARCH%	ENG%	QS%	CON%	Ave.%
Lack of available funding	27	42	26	36	33
Difficulty in proving that the benefits of IT are greater than the associated costs	35	18	21	12	22

ENVIRONMENT REASONS	ARCH%	ENG%	QS%	CON%	Ave.%
Conservative Industry that is slow to change	16	15	16	33	20
Project driven Industry with short term outlook	16	27	18	15	19
Complex / fragmented Industry	8	15	32	18	18
Susceptibility of Industry to economic climate	14	15	8	21	14
Majority of companies in the Industry are SME's	3	15	3	9	7
Majority of clients are not construction experts	8	3	5	0	4

Figure 10: What reasons are hindering the use of IT in your company ?

e)   **Strategy and IT**

The questions and answers in this section are mainly related to how strategic is the use of IT within each of the four sub-sectors. The original intention with regard to the questions relating to IT strategy was to use the 28 questions in the Strategic IT Health Check (Construct IT, 1997). During the pilot phase of the survey however it became clear that these questions were either unlikely to be answered in full or produce meaningful answers. Instead of these questions the participants in the survey were asked relatively simple questions relating to their IT Strategy, their business reasons for using IT, their relative IT position in relation to their competitors and also the relationship between IT and clients.

  There was an even response among the four sub-sectors as to whether firms had an IT Strategy and it is disappointing to note that only an Average of 41% have such a strategy. Futhermore over half of those firms that do not have an IT Strategy at present gave the vague reply that they will not develop and adopt one in 1998 or 1999 but will do so 'sometime in the future'. Even more worryingly a number of firms

(Average 7%) indicated that they would never develop and adopt an IT Strategy. This latter response may indicate an unwillingness to give IT a status that the respondents feel it does not deserve.

There was a mixed response to the question concerning the influence of IT on business strategy [Figure 11]. It is perhaps surprising to see the difference between Architectural and Consulting Engineering sub-sectors but less of a surprise to note that Contracting sub-sector were lowest in stating that IT has a major influence on business strategy.

When asked about their IT use in relation to their competitors the vast majority of respondents (Average 78%) believe that they are either the same or ahead. There was a high rate of consensus about using IT to make existing activities more efficient with an Average of 86% confirming that they are doing so. The response to the important question of whether firms were prepared to change the way their activities are carried out to take more advantage of IT is encouraging. An Average of 84% stated that they were prepared to change and this high proportion will hopefully lead to greater exploitation of IT within the construction sector in general. This optimism must be cautioned however by the preceding results indicating the low current and likely future levels of strategic thinking regarding IT.
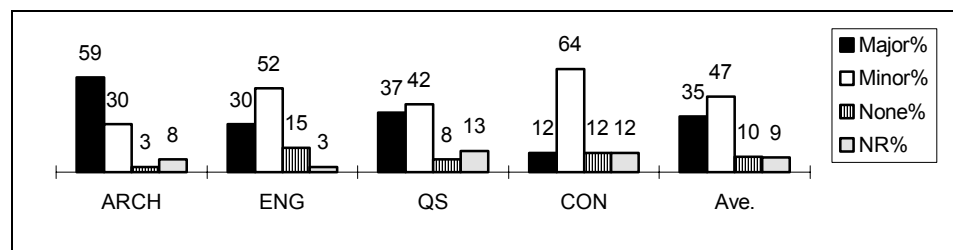

Figure 11:   What is the influence of IT on your company's business strategy?

The responses to whether firms have clients that are insisting on particular IT produced some contrasting results. The Contracting sub-sector Yes rate of 61% is surprisingly high and the Quantity Surveying sub-sector Yes rate of 31% is significantly lower than the other three sub-sectors. The was a general increase in agreement that clients will insist on specific IT facilities from a current Average of 57% to an estimated Average of 87% in five years time. There is strong opinion, particularly within the Consulting Engineering and Quantity Surveying sub-sectors, that IT could not be used in 1998 by clients to obtain more cost effective services outside Ireland. It is surprising to note that all four sub-sectors are generally even stronger in their opinion that clients will not use IT to obtain most cost effective services outside Ireland in five years time.

f) General influence of IT on the Irish construction sector

The questions and the associated results in this section are subjective rather than factual in that the participants in the survey were asked for their opinions on a number of general issues related to current

and future use of IT in the Irish construction sector. These issues include the relationships between IT and human participation, IT and paper and IT and integration.

The majority of the Architecture, Consulting Engineering and Quantity Surveying sub-sectors believe that IT has had a major influence on the Irish construction industry over the past five years. In contrast the majority of the Contracting sub-sector believe that this influence was minor. There was a high level of consensus between all four sub-sectors however that IT will have a major influence on the Irish construction industry during the next five years (Average 68%). It was interesting and surprising to note that the Architectural sub-sector was very strong in its opinion (86%) that IT will not lead to a decrease in human input/participation in Architectural design over the next five years. This was also the case for the Contracting and Consulting Engineering sub-sectors where 76% and 67% respectively thought that IT will not lead to a decrease in human input/participation in relation to their activities. In contrast the Quantity Surveying sub-sector were not as strong in their opinion with 53% believing that there will not be a decrease in human input/participation in Quantity Surveying over this period.

With regard to IT and paper an Average of 79% agreed that IT has led to the generation of more paper. This is in line with expectations although it should be noted that the Quantity Surveying rate of agreement (60%) was low relative to the other three sub-sectors and this may indicate that the increase in paper is more design related. It was encouraging to note that there is a general decrease in agreement that the use of IT in the future will lead to the generation of more paper when compared with the use of IT to date (Average 50% from Average 79%). These results however would also indicate that the concepts of paperless offices and paperless systems are not seen as viable propositions by many in the four sub-sectors.

Two very important questions included in the survey related to IT improving the integration of the work of participants in the construction industry [Figures 12 & 13]. The results to these questions are encouraging in that all four sub-sectors show an increase in believing that IT will improve the integration over the next five years compared with the previous five years.
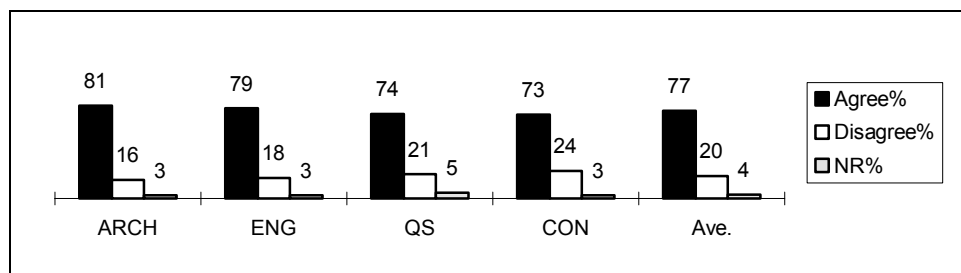

Figure 12: Do you agree that the current use of IT has improved the integration of the work of participants in the construction sector?
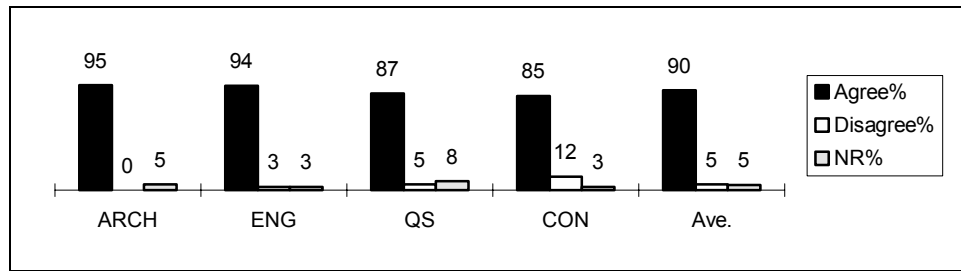
Figure 13: Do you agree that IT will improve the integration of the work of participants in the construction sector over the next five years ?

INTERNATIONAL COMPARISON

Other similar surveys that have been carried out within six months of the survey described in this paper include the following:

(i) A study by the Barbour Index in the UK (1998) contained questions of a general nature concerning current and future IT use and was answered by in excess of 6000 individuals from a variety of construction related disciplines;

(ii) A Strategic IT Health Check in Hong Kong (1998) survey focused on the strategic use of IT by contracting firms that are on the government approved list;

(iii) The IT Barometer in Sweden and Denmark (1998) included a wide range of questions regarding current and future use of IT, IT personnel and IT strategy with the target group of various consulting, contracting and building management firms selected as being representative of the construction sectors in these countries.

There is a limit to the extent of comparison that can be made between these different surveys as there is a variation in both the questions asked and the classification of individuals and firms that supplied answers. Of these three the IT Barometer is closest to the Irish survey described in this paper. Although a direct and exact comparison is not possible, the following general comments can be made in relation to the current and future use of IT by the leading Architectural, Consulting Engineering and Contracting firms in the Rep. of Ireland and that of similar sub-sectors in Sweden and Denmark. (Note: Quantity Surveying and associated activities were not specifically identified in the Danish and Swedish surveys.)

(i) The ratio of numbers of computers to numbers of staff by the leading Architectural, Consulting Engineering and Contracting firms in the Rep. of Ireland is less than that for the equivalent sub-sectors in Sweden and Denmark.

(ii) CAD use by the leading Architectural, Consulting Engineering and Contracting firms in the Rep. of Ireland is at approximately the same high levels in the equivalent sub-sectors in Sweden and greater than that in Denmark.

(iii) AutoCAD followed by Microstation are also the two most popular CAD software systems in Sweden and Denmark but the dominance of these systems, particularly AutoCAD, is even stronger in the leading Architectural and Consulting Engineering firms in the Rep. of Ireland.

(iv) The dominance of Microsoft Office as the chosen office administration software by the leading Architectural, Consulting Engineering, Quantity Surveying and Contracting firms in the Rep. of Ireland (Average 88%) is mirrored in the Swedish construction sector (90%) and to a lesser extent in the Danish construction sector (68%).

(v) The connection rate to the Internet by the leading Architectural, Consulting Engineering, Quantity Surveying and Contracting firms in the Rep. of Ireland (Average 84%) is greater than that of the average in the Swedish and Danish construction sectors (60%).

(vi) Access to e-mail facilities in the leading Architectural, Consulting Engineering, Quantity Surveying and Contracting firms in the Rep. of Ireland (Average 82%) is greater than the average in the Swedish construction sector (60%).

(vii) The number of the leading Architectural, Consulting Engineering, Quantity Surveying and Contracting firms in the Rep. of Ireland having pages on the world wide web (Average 19%) is well below that of the average figures in Sweden (60%) and Denmark (38%).

In summary these comments would indicate that the leading Architectural, Consulting Engineering and Contracting firms in the Rep. of Ireland are behind the equivalent sub-sectors in Denmark, and particularly Sweden, in some respects (e.g. the ratio of computers to numbers of staff, homepages on the www) but they are ahead of the equivalent sub-sectors in Denmark, and to a lesser extent Sweden, in others (e.g. access to the www, access to e-mail facilities).

CONCLUSIONS

This paper presents the findings of a questionnaire survey conducted amongst the leading Architectural, Consulting Engineering, Quantity Surveying and Contracting firms based in the Republic of Ireland. The objectives of the survey were to discover the extent of their current use of IT, to determine their level of strategic approach to IT and to estimate their potential use of IT and that of the Irish construction sector in general. The results show that IT is currently being used extensively by these firms and that their use of IT is likely to continue and increase in the future. There are however a number of reasons hindering the better exploitation of IT by these firms and these reasons are similar to those in other construction sectors around the world.

In spite of the extensive current use and estimated increased future use of IT by the firms who participated in this survey, the majority do not have an IT strategy and are unlikely to develop and use such a strategy in the near future. This apparent general lack of strategic thinking in relation to IT is both disappointing and a major cause of concern for the future investment and use of IT by these firms and the construction sector in general. On a positive note however, there is evidence to suggest that the leading firms in the four sub-sectors are prepared to change the way their existing activities are carried out to take more advantage of IT. It is also encouraging to acknowledge the consensus that IT will improve integration between participants in the Irish construction sector over the next five years.

It is unclear how the current and future use of IT by the leading firms in the Architectural, Consulting Engineering, Quantity Surveying and Contracting sub-sectors in the Rep. of Ireland compares with that of the equivalent firms in other countries. More accurate comparisons of the use of IT in different national construction sectors would be useful to all concerned parties as such comparisons could lead to the identification of best practices and a subsequent increase in exploitation of IT by the global construction industry.

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