A SURVEY OF THE IMPACT OF THE INTERNET ON SCIENTIFIC PUBLISHING IN CONSTRUCTION IT AND CONSTRUCTION MANAGEMENT

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SUMMARY: The World Wide Web provides the opportunity for a radically changed and much more efficient communication process for scientific results. A survey in the closely related domains of construction information technology and construction management was conducted in February 2000, aimed at measuring to what extent these opportunities are already changing the scientific information exchange and how researchers feel about the changes. The paper presents the results based on 236 replies to an extensive Web based questionnaire. 65% of the respondents stated their primary research interest as IT in A/E/C and 20% as construction management and economics.

The questions dealt with how researchers find, access and read different sources; how much and what publications they read; how often and to which conferences they travel; how much they publish, and what are the criteria for where they eventually decide to publish. Some of the questions confronted traditional and electronic publishing with one final section dedicated to opinions about electronic publishing.

According to the survey researchers already download half of the material that they read digitally from the Web. The most popular method for retrieving an interesting publication is downloading it for free from the author's or publisher's website. Researchers are not particularly willing to pay for electronic scientific publications. There is much support for a scenario of electronic journals available totally freely on the Web, where the costs could be covered by for instance professional societies or the publishing university.

The shift that the Web is causing seems to be towards the "just in time" reading of literature. Also, frequent users of the Web rely less on scientific publications and tend to read fewer articles. If available with little effort, papers published in traditional journals are preferred; if not, the papers should be on the Web. In these circumstances, the role of paper-based journals published by established publishers is shifting from the core "information exchange" to the building of authors' prestige. The respondents feel they should build up their reputations by publishing in journals and relevant conferences, but then make their work freely available on the Web.

1. INTRODUCTION

The advent of the Internet has offered the means for thorough changes in the scientific publishing process and has over the past decade led to the establishment of several hundred refereed journals which have used the world wide Web as the only or primary publishing format (Wells, 1999). The majority of these are free of charge and are run by academics or non-profit societies, with the primary objective of offering a service which would remedy some of the short-comings of the traditional paper-based publications. In parallel the large commercial publishers have been facing a crisis and have been forced to devise strategies which enable them to survive in the Internet era. Thus most journals now offer tables of contents or abstracts for free on the Web, and in many cases

they sell subscription schemes which offer both the traditional paper-based version and access to a full-text digital version.

All the major "players" in the scientific publishing process are currently faced with a quickly changing environment:

Readers of scientific literature are facing the situation where the majority of all the information that they need to retrieve is only a few mouse-clicks away and available for free. This has the added side-effect that retrieving publications involving extra effort (such as going to a university library), a long waiting time (i.e. ordering a paper copy through a traditional interlibrary service) or an extra cost (i.e. paying 20 US$ for downloading a digital copy of an article) is growing unpopular. Students writing M.Sc. thesis at the author's institutions nowadays use almost exclusively material available for free on the Internet as references to their work. Butterworth (1998) reports that Ph.D. students in his particle physics group "never, but never, look at a printed journal". For reasons like this, as well as constantly rising subscription prices, university departments and libraries are cancelling their subscriptions to all but the most essential journals.

Authors are faced with the dilemma of choosing where to publish their results. If in a journal, should they prioritise journals with a fast turnover rate from submission to publication, which can be achieved by electronic-only journals with no need to wait for scheduled issues? Especially in fast-moving fields such as any IT related research, a waiting time of one year or more seems very prohibitive. Or should they prioritise a potentially large readership, which the major journals and freely available electronic journals can achieve. Other important criteria include that a journal is indexed by some well-known indexing services, or that the journal has a high academic status, in terms of earning the author merits and in some cases even funds for his department.

Publishers have to make choices about whether to publish full text on the Web in addition to the printed version, and if so what format to use. They also need to decide how to make use of the possibilities offered by the medium in terms of hyperlinking, indexing, multi-media, email alerting services etc. The crucial question, however, is the pricing of the product. Is the price of the electronic version about the same as for the paper version? How should the site be protected from others than paying customers, by individual password protection or site licensing to universities? Another issue is whether to allow only yearly subscribers access to the full text or also set up a mechanism to sell individual articles digitally, possibly using a specialized third party service?

Libraries will see their role as intermediaries change radically in the future. The need to have paper copies on display and archived will diminish radically. Maybe a more important function will be to negotiate for the electronic site licenses of the university. Currently the question of long-term digital archiving is receiving increasing attention (Hodge and Carrol, 1999). Studies show that already in the traditional paper-based process the total archiving cost for journals (the sum for all libraries world-wide archiving a particular journal) are greater than the original publication costs of the publisher (Odlyzko, 1998). With electronic archiving these costs can be reduced radically since the need for duplicating the archiving effort locally disappears. One obvious future development would be that publishers increasingly start to assume the archival role for their journals. This, however, entails a lot of unsolved issues and risks. What happens when a university stops subscribing to an electronic journal. Do they still have the right of access to those volumes for which they already paid (in the paper process they would retain physical possession of the issues)? What happens when a publisher goes out of business, or disappears in a merger? What guarantees are there that the old digital issues will be stored at all. An example of this type of problem is offered by the case of Interactive Construction Online, a Web-based journal which was published during 1996-97. As the original commercial publisher was bought by another company, the new owner decided that the journal no longer was a good business proposition. In the process all the files with the already published articles were lost (De la Garza, 2000).

2. THE GENERAL SITUATION OF SCIENTIFIC PUBLISHING

Scientific publishing is currently at a cross-roads in its development. In view of the World Wide Web providing a medium for the rapid and free spread of scientific information, the interests of the commercial publishers and the authors and readers are in direct conflict. For a number of years commercial publishers have been forced to raise the subscription prices to periodic journals faster than inflation, which tends to further reduce the number of subscribers. This viscous circle has been named the "periodical´s crisis" (Walker, 1998). At the same time a number of idealistic researchers have founded electronic journals that are available for free in the Internet. Wells

(1999) found 387 free electronic scientific journals in her study. Also she found that 25% of the journals which at one stage or another had advertised in the NewJour website (http://gort.ucsd.edu/newjour) could be considered dead. This high mortality rate is quite typical since new journals have a hard time attracting authors, without the backing of established commercial publishers or learned societies.

A survey done in 1998 by the International Council for Scientific and Technical Information on how researchers use Internet based services showed that 61% of respondents felt that electronic journals/trade magazines are easy to use/user friendly, but that only 14 % of respondents publish in such journals (Anon, 1999). Thus it seems that as readers of journals scientists are very progressive and supportive of free electronic journals, but as authors of articles they are very conservative in their choice of where to submit their manuscripts. In a discussion of the economics of electronic journals, Odlyzko (1998) observes that one future scenario is that: "scholars will continue submitting their papers to the most prestigious journals they can find, no matter how small their circulation, since prestige is what counts in tenure and promotion decisions, and since everybody that they want to read their papers will get them electronically from preprint servers in any case".

In the literature published on scientific electronic publishing there is clear disagreement on the question of whether electronic journals are much cheaper to run than paper-based ones. For good discussions see King and Tenopir (1998) or Odlyzko (1998). It seems that the opinions of different proponents are largely dependent on the view taken. If one looks only at the cost borne today by a commercial publisher the costs for running an electronic-only, but subscription-based journal, may not differ much from paper publishing. This has to do with the fact, that for the low subscription numbers typical for the majority of scientific journals, the fixed costs accruing from marketing, editing, typesetting, general overhead etc. are much higher than the variable cost related to printing and distribution. If on the other hand one takes a broader view of a process starting with an author preparing a draft manuscript to another researcher retrieving and reading the same article 10 years later, there are strong indications that the electronic process is much cheaper. Another important issue is that the costs to libraries for archiving journals and for readers of identifying and retrieving an article should be taken into account. In particular the latter costs have been ignored in most of the cost estimates published.

3. SCIENTIFIC PUBLISHING IN CONSTRUCTION MANAGEMENT AND CONSTRUCTION IT

Electronic journals have also been founded in the domain of civil engineering research, and are enjoying moderate success (The home page of one such journal is shown in Figure 1). In this study an in-depth look is taken at the current publishing situation in the two areas of Construction Information Technology and Construction Management and Economics, based on personal experiences of editors who have been in the middle of the "battle ground" and who have also collected objective data through a variety of means. The choice of construction IT was obvious, given the background of the authors as researchers and publishers of an electronic journal in the domain (Electronic Journal of Information Technology in Construction). Construction management and economics has been included due the fact that there is considerable overlap and synergy between these two research communities, both on the personal level, in conference attendance and in the choice of journals in which to publish.

Aspects of scientific publishing in these areas have been discussed in at least three earlier papers. The editors of the Journal of Computing in Civil Engineering have done a detailed analysis of the articles published in their journal during the years 1987-96 (Lakmazaheri and Rasdorf, 1998). There are some useful results concerning the distribution of topics covered and the geographical distribution of authors, but overall performance figures such as the approval rate of submissions or throughput time from submission to publication are not included. In a recent conference paper, Loosemore and Runeson (1999) criticise the impartiality of the scientific review process in the construction management domain. They conducted an experiment with a mock-up submission to a non-existent journal, which resulted in reviews ranging from excellent to poor (almost following a Gaussian curve). Finally scientists have taken part in surveys rating the journals of a domain (Chau, 1998). Unfortunately, none of these papers takes a holistic view of the publication process or questions its basic functionality.

The efficiency of the scientific publishing process in our domain is not a trivial issue. Most researchers spend around one third of their yearly working time writing, reviewing, retrieving and reading scientific articles and conference paper. The parallels to using IT to facilitate the design and construction process are obvious. Claims that the construction industry is conservative and slow in adapting new methods and tools offered by the

developments in IT are commonplace. The construction industry has in this respect often, to its disadvantage, been compared to other industries such as the car industry. But the same observation applies to us as a scientific community as well. Maybe our scientific publishing process should be benchmarked against some other more advanced scientific communities? A good candidate for a best common practice yardstick to measure us against could be the physics community, where the Los Alamos electronic preprint archive (arXiv.org, 1999) processes about 20,000 papers per year, at an estimated cost of US$ 5 per paper. This figure should be compared to the US$ 4000 per paper (Odlyzko, 1998) quoted as the publisher's revenue from subscriptions, and thus equal to the publisher's costs + overhead, for an average paper-based journal!

Figure 1: The home page of the Journal of Design Computing, an example of a new breed of electronic only journals.

4. THE SURVEY – METHOD AND RESPONSE

The first phase of this research was an extensive survey of authors and readers of scholarly articles and conference papers. The purpose was to empirically survey the current situation, as well as to identify recent trends in usage and opinions. The research technique used has been a general Web questionnaire to authors/readers combined with case studies of individual journals and conferences (Appendix 1).

The publication and reading of scientific journal articles, cannot be studied in isolation, since it belongs to the larger context of how researchers acquire the data and knowledge that is used as an "input" into their own research. The survey was thus designed to include a comprehensive overview of the scientific information exchange, reading and publishing habits, among the researchers. For this reason other means of scientific communication, ranging from attending conference presentations to informal email exchange and visits to construction sites, have also been included in the survey.

The survey tries to look at the scientific publishing process in one particular scientific community as a whole, rather than concentrating on the case study of one single journal or looking at scientific publishing in general. The survey did not target the information exchange between research and practice. This is a complex question that would well merit a separate research project. This concern was present in some comments made by the respondents, for example:

I have been generally satisfied with the readership and academic acceptance of my publications, but I am bitterly disappointed in how little my work has affected practice. It is also a little disappointing that your survey covers authorship and readership, but not one question deals with practical impact of authors' papers. Are we really just publishing for publishing's (and promotion's) sake?

The questions (see Appendix 1) were grouped into the following sets:

- Questions about personal information to establish age, job, function and research topic of the respondent.

- Questions on how people find, access, and read information sources.

- Questions on which journals people follow, what conferences they attend and how often.

- Questions related to publishing of their work, how much they publish, what influences the decision where to publish.

- Questions related to electronic publishing.

In total, there were 27 major questions, including 169 sub-questions that demanded an answer, usually in the form of selecting one option from a choice of five (e.g. 1=strongly disagree to 5=strongly agree or 1=not important to 5=very important). Some of the questions also required respondents to input a number (e.g. how many papers do you read per year). The form was designed in Microsoft Word and then translated into a Web-based form (Figure 2) that fed the answers into a file, which could be opened by popular spreadsheet programs.

Figure 2: Questionnaire form on the Web. Also see Appendix 1.

The form was announced on the Web on the 14th of February 2000 and the presented results are based on the data that accumulated during one month, until 14th of March. The survey was announced electronically to mailing lists subscribed by academics and researchers in the selected field and also to any person who has at any time in the last seven years shared the same cyberspaces as the second author of this paper. Ziga Turk's mailbox was scanned for email addresses, most of which professional contacts. We estimate that the email announcements, either direct or made by our acquaintances, reached between 3000 and 3500 persons. About 800 curious individuals actually followed the link to the form on the Web, 247 tried to fill in the form. A total of 236 of those answered at least 45% of the questions that were required for completion of the submission. The results presented here are based on these 236 responses, 65% are from persons who stated that their "main interest area" was information technology in architecture/engineering/construction and 20% who stated it was construction management and economics.

Theoretically, the response rate compared to the original mailing was a little over 7%, however, given the number of the researchers in the fields and active participants at conferences, we can estimate that at least in the construction IT domain we have reached a very significant number of professors and university academics. If the responses are compared to the people who actually had a look at the Web questionnaire, then the response rate is closer to 29%. We had hoped that more students and younger researchers would complete the survey - the ratio between the students and the professors should be at least 3:1, however, the student population is not stable and seems not to be leaving a lasting email trace on the Internet. In addition, dated email addresses for students may not have been reaching their target as some students have moved off to other opportunities after graduation.

An average respondent answered 82% of all questions. Figure 3 shows some basic demographics figures.

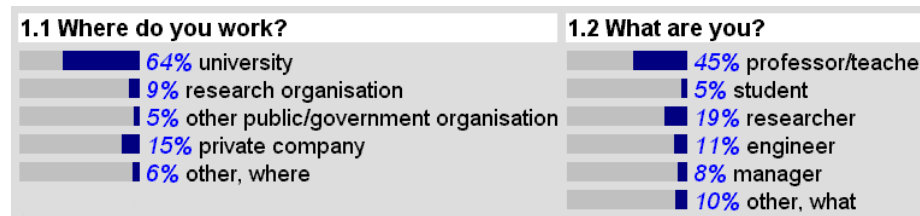| 1.1 Where do you work?	1.2 What are you?
64% university	45% professor/teacher
9% research organisation	5% student
5% other public/government organisation	19% researcher
15% private company	11% engineer
6% other, where	8% manager
	10% other, what

Figure 3: Some demographics of the survey – this figure is dumped from the Web where users can explore the survey results interactively (Appendix 2).

We were pleasantly surprised by the volume and speed of the response (Figure 4). Although it took an average respondent 26 minutes to fill in the form (the system measured the time between displaying the form and the time at which it was submitted), more than half of all replied to the form in the first 24 hours and 75% during the first week. After one week other announcements were made; therefore we can assume that people respond to emails either very quickly or not at all. It is also noticeable in the data that the construction management community reacts to emails more slowly. The responses came from 47 different countries (17% UK, 11% USA, 9% Sweden, 7% Australia, 5% The Netherlands, 4% Germany and Canada, 3% Belgium, Finland, Slovenia and Denmark).

The average age of the respondents was 44 years (question 1.4). The survey was anonymous; however, there was an optional field where the respondents could provide their email address (question 1.6). Only 20% preferred to hide it.

The discussion in the following sections is a summary of some of the more interesting results as shown in Appendix 2 as well as results of a correlation analysis among the 161 sub-questions. Figure 6 shows a correlation matrix where relatively high correlations (>+0.5) are painted dark green (>+0.25) light green and negative correlations (< -0.25) orange. Absolutely, correlations were not very high, because most are based on answers where values between 1-5 had to be selected. This analysis enabled us to find correlated questions quickly. Figure 6, for example, shows that the construction IT and construction management communities are rather distinct - correlation exists for the visits of the conferences in each field separately.
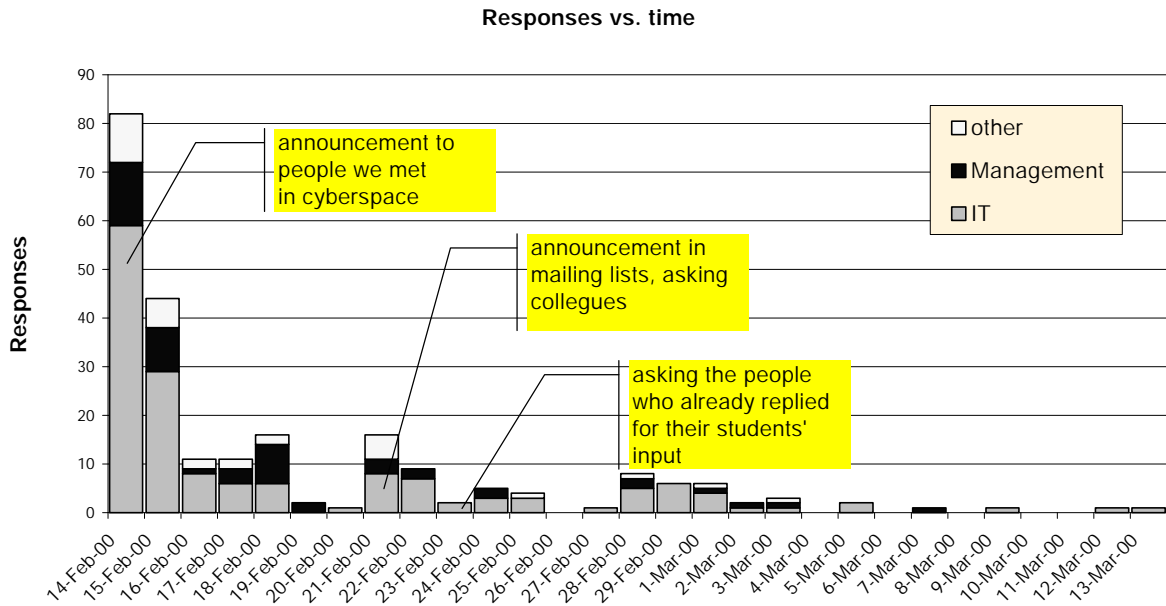
Responses vs. time
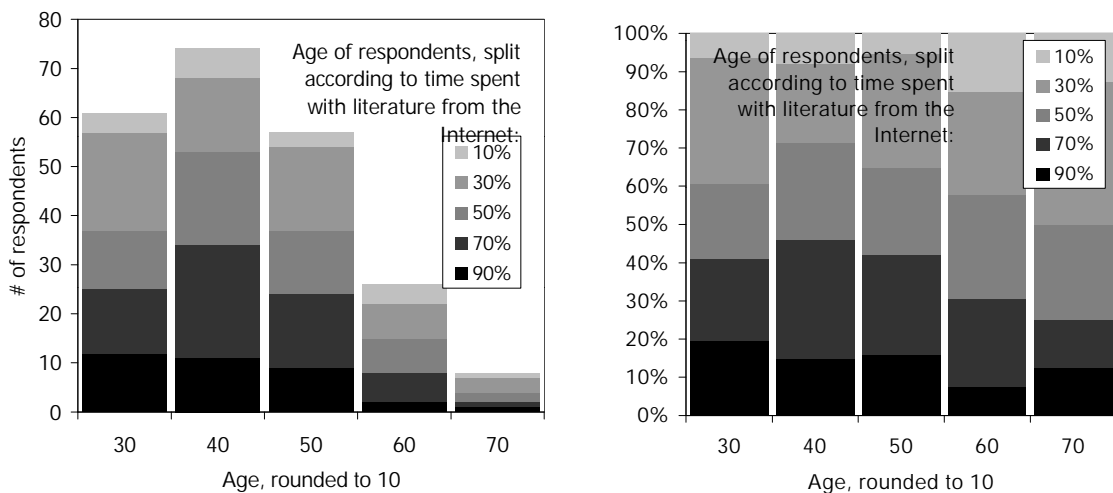

Figure 4: Number of responses vs. time.

Figure 5: Age vs. the use of the Internet. Note that the heavy use of the Internet drops with age, however the population from 35-45 uses the Internet slightly more than younger or older colleagues.

5. READING HABITS

The survey showed (question 2.1) that personal discussions are the most important source where we learn "about what is going on and should be of relevance" (3.9 on 1 for low through -5 for high scale), followed by books (3.7), journals (3.6) and conference proceedings (3.4). The question did not ask about the medium (e.g. paper or the Internet), however, many respondents used the option "other" to say that they use the Web as such and do not care if the publication on the Web is a journal article, report, or book. The relatively least utilised sources are mailing lists and workshop presentations.

To "identify or find particular interesting items worth reading" (question 2.2) the most important are "references in other publications" (4.0), Web search using general (3.9) or topic specific search engines (3.6) and hyperlinks (3.7). Among the least important are searches in the traditional bibliographic databases (2.7) or browsing in libraries (2.3) or the Web, not looking for something in particular (2.8). This set of answers clearly shows the

strong preference for the just-in-time search in the readily available (references in other publications) or free (Web) resources. According to the survey, just-in-case browsing is somehow more important to the professor/teachers cohort than other groups. This might be explained by the fact that the professor/teachers cohort through their network and connections receive many more free paper copies of material which they browse compared to junior researchers and Ph.D. students. Their function is also to keep a broad perspective which they can maintain through the just-in-case browsing.

1.1.1 university	2.2.9 identify	2.2.10 Following	2.2.11 Searching	2.2.12 using	2.3.1 contact	2.3.2 department	2.3.3 order	2.3.4 contact	2.3.5 download	2.3.6 publisher	2.3.7 download	2.3.8 publisher	2.4.1 Material	2.4.2 Internet	3.1.1 Journal	3.1.2 Building	3.1.3 Research	3.1.4 Construction	3.1.5 Engineering	3.1.6 International	3.1.7 Journal	3.1.8 Building	3.1.9 Journal	3.1.10 Engineering	3.1.11 Automation	3.1.12 Computer	3.1.13 Aided	3.1.14 Electronic	3.1.15 International	3.1.16 Journal	3.1.17 Computing
2.4.1 Material	#	#	#	#	0	0	0	#	#	#	#	#	1																		
2.4.2 Internet	#	0	0	\	#	#	#	0	0	0	0	0	#	1																	
3.1.1 Journal	#	0	0	0	0	0	0	0	0	0	0	0	0	#	1																
3.1.2 Building	#	0	0	0	0	0	0	0	0	0	0	0	0	#	0	1															
3.1.3 Research	#	0	0	0	0	0	0	0	0	0	0	0	0	#	0	1	1														
3.1.4 Construction	#	0	0	#	0	0	0	0	0	0	0	0	0	#	1	0	1	1													
3.1.5 Engineering	#	0	0	0	0	0	0	0	0	0	0	0	0	#	1	0	1	1	1												
3.1.6 International	#	0	0	0	0	0	0	0	0	0	0	0	0	#	0	0	0	0	1	1											
3.1.7 Journal	#	0	0	0	0	0	0	0	0	0	0	0	0	#	1	0	0	1	1	1	1										
3.1.8 Building	#	0	0	0	0	0	0	0	0	0	0	0	0	#	0	0	0	1	1	1	0	1									
3.1.9 Journal	#	0	0	0	0	0	0	0	0	0	0	0	0	#	1	0	0	1	1	0	1	0	1								
3.1.10 Engineering	#	0	0	0	0	0	0	0	0	0	0	0	#	0	0	0	0	0	0	0	0	0	0	1							
3.1.11 Automation	#	0	0	0	0	0	0	0	0	0	0	0	#	0	0	0	0	0	0	0	0	0	0	0	1						
3.1.12 Computer	#	0	0	0	#	#	0	0	0	0	0	0	#	0	0	0	0	#	0	0	0	0	0	1	1	1					
3.1.13 Aided	#	0	0	0	0	0	0	0	0	0	0	0	#	0	0	0	0	0	0	0	0	0	0	1	0	1	1				
3.1.14 Electronic	#	0	0	0	0	0	0	0	0	0	0	0	#	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1			
3.1.15 International	#	0	0	0	0	0	0	0	0	0	0	0	#	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1		
3.1.16 Journal	#	0	0	0	0	0	0	0	0	0	0	0	#	0	0	0	0	#	0	0	0	0	0	1	0	1	1	0	1	1	
3.1.17 Computing	#	0	0	0	0	0	0	0	0	0	0	0	#	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	1	0	1

Figure 6: Part of the correlation matrix. Row and column headers refer to the question numbers. Dark green cells mean significant correlation. Exact correlation values are not reproduced because the cells are to narrow. Refer to Appendix 1 for full text of the question numbers.

The interesting publications, when not readily available, are most often retrieved (question 2.3) by downloading them for free from the author's (3.9) or some organisation's website (3.5). Going to the library to fetch a publication or ordering it through a library service is nearly a whole level less important (3.1). There is a positive correlation between "downloading from an author's website", the use of "topic specific portals and search engines", "browsing the Web not looking for something in particular", "following hyperlinks", "trying out IT tools", and, of course, the requirement for "fast access to Web sites". Few individuals contact the author and ask for a copy, however, if they do, they do not care much whether it is a paper (2.5) or a digital copy (2.4). In fact, there is a strong correlation between the two showing, that some simply go and ask the author, no matter if a paper or digital copy is in question. It seems however, that those who would ask for a digital copy find it on the Web anyhow. Definitively, researchers in our community do not want to pay for electronic documents either through paid subscriptions or pay-per-view mechanisms (1.7 and 2.0 on a 1-5 scale).

One of the simplest but key questions (question 2.4) in the survey was "Estimate the way you received or accessed all the material that you read, Internet vs. paper. Enter in percentages of time spent reading each category, adding up to 100". The average respondent does it almost 50-50%, there are, however, insignificant differences when it comes to age (Figure 5). For the construction management respondents only, the ratio is 65:35 in favour of paper, while for the construction IT, the ratio is 45:55 thus favouring the Internet. Those who use the Internet a lot do not read or subscribe to journals, because they find "essentially the same information on the Web". They believe that "a paper on the Web will be read by more colleagues than one printed" and that "a

paper on the Web is more likely to generate personal contact with readers". Apart from this there are no other significant correlations between this information and the views on electronic publishing.

Surprisingly, the professor/teachers use the Internet more than the students. The heaviest users of the Internet are engineers and professors not working at a university (Figure 7). The Internet seems popular in environments where traditional paper publications are not available, are difficult or too much trouble to get, or where tangible results are expected quicker (engineers, researchers, non-university environments). This chart also shows that the biggest opportunity of the Internet lies in the vertical communication of the scientific results between the academia, research and practice. The respondents from research and practice, however often found scientific articles "too academic or too long".
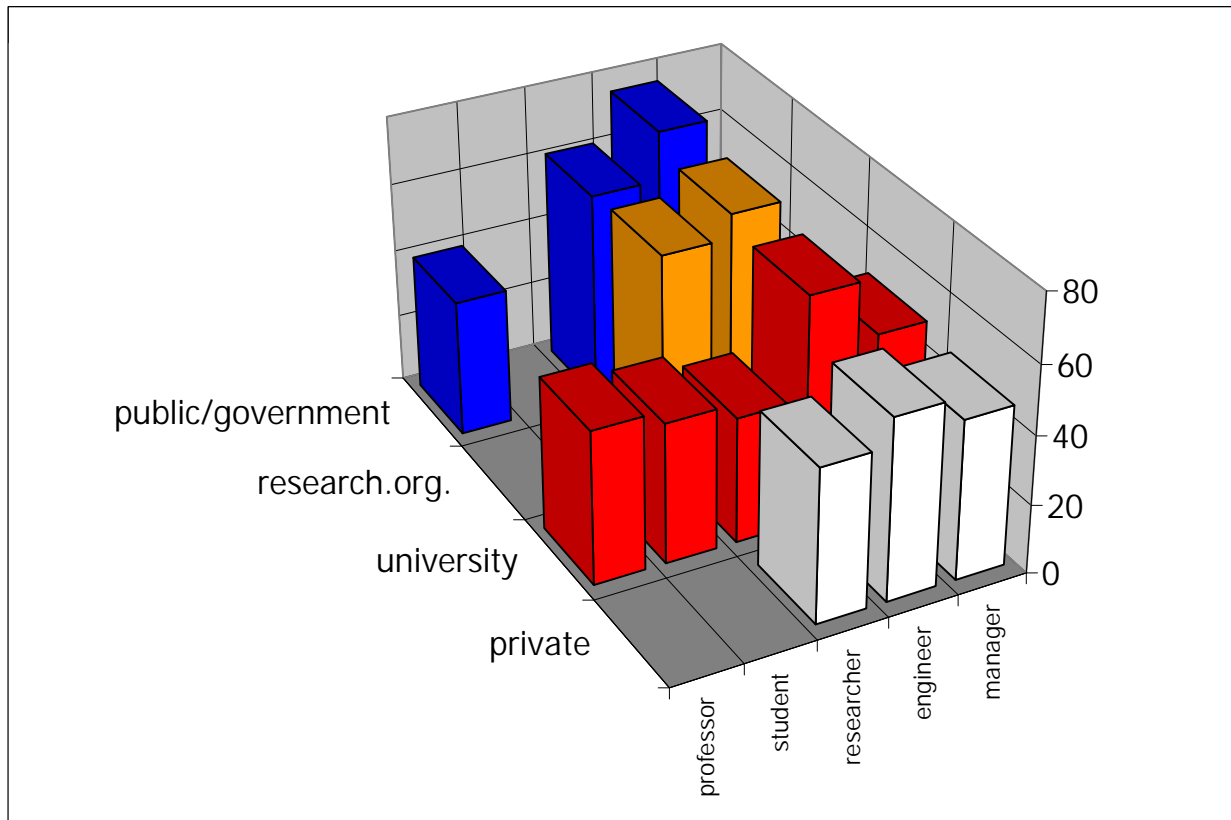

Figure 7: Part of time spent (in %) reading scientific information retrieved over the Internet rather than in paper form, split by the job function and affiliation.

6. READERSHIP OF JOURNALS AND VISITS TO CONFERENCES

Section 3 of the survey was dealing with the readership of journals and conference participation. 55% percent of the respondents were not familiar with and average journal listed (question 3.1) and 70% were not familiar with an average conference (question 3.4) listed. The best known journals in the area of construction management and general civil engineering were (1=not familiar and 5=read regularly):

2.4   Construction Management and Economics

2.3   ASCE Journal of Management in Engineering

2.3   ASCE Journal of Construction Engineering and Management

In the area of construction IT and related topics, the full list of journals was:

2.5	Computer Aided Design
2.3	Automation in Construction
2.3	Electronic Journal of Information Technology in Construction
2.2	Journal of Computing in Civil Engineering
2.1	The International Journal of Construction Information Technology
2.0	International Journal of Computer Integrated Design and Construction
1.9	AI in Engineering
1.9	Computer-Aided Civil and Infrastructure Engineering
1.9	International Journal of Design Computing

On average (question 3.2) the survey respondents "browse through or read in detail" 107 papers per year and travel to 2.75 conferences. Some manage to read 500, 1000 or even 2000 papers a year! A group that reads more is construction management people (average 130), "working at a university" (average 128). Construction IT colleagues read less (102), particularly the students (60). In all, those declaring themselves as "researchers" read more (176), which is more than the professors (103), students or engineers (78) and managers (8).

Professors seem to attend twice as many conferences (question 3.5) as students per year (3.4 vs. 1.7). Construction management people travel to conferences more than their IT colleagues (3.2 vs. 2.5). For some strange reason, there is a relatively strong correlation between the number of conferences visited and time taken to fill in the form! This was the strongest correlation to the time taken to fill in the form. Heavy Internet users travel less than other cohorts.

People who spend more than 55% of the time with material retrieved over the Internet seem to read fewer articles (95). Why don't people read more (question 3.3) - mostly the reason is: "simply don't have time to read more than I do currently" (3.9). People who did not find this reason important "browse the Web, not looking for something in particular" a lot and or learn a lot from books. . . Other important reasons for not reading more are subscription problems (3.6) and wrong topics (3.4). There is a positive correlation among those who found "content available elsewhere" and finding "the papers too long or academic".

7. AUTHORING OF PAPERS

Of the respondents, 85% have at some time during their career written a conference or journal paper (question 4.1). In the last three years they authored or co-authored 7.7 conference papers and 4.8 journal papers (question 4.2). This fits with the number of conferences they had attended. The survey also indicated there is a strong correlation between people writing any kind of publications; those who publish more, publish more in any of the formats.

The important reasons for publishing in journals (question 4.3) are "to inform others about your work and results" (4.2) and to "gain credits for academic advancement" (3.6). When deciding about where to submit an article (question 4.4), the most important reasons are relevant readership (4.2) and high academic status (3.9). Being on a "shortlist of approved journals (promotion, funding)" is much less important (2.9). Ironically, respondents don't care much if journal articles are available for free on the Web (very important for them, when asked as readers, but not when asked as authors!). This should, given the preferences for finding and retrieving the information, be essential if their aim is to actually inform others about their work - unless, of course, the "others" are not their peer researchers. One could speculate that publishing in a reputable journal, despite the answers given in the questionnaire, is more important than a large readership. Some comments given in the Web form are also indicative:

> *Until the motivation for publishing is true to the intent of archiving and disseminating knowledge, rather that just an academic requirement for promotion and tenure, or a $$$ opportunity from a publisher's perspective, we will still have a lot of meaningless published work around...*

And also:

The form failed to address the most significant issue to many of us. We need a media, which serves the need to get information - not to publish it for academic merits. There are too many publications containing similar papers from the same authors. Too many papers mostly refer to other papers without having any original content. The value of journals is becoming questionable.

42% agree or strongly agree that the review process is not blind, 47% that reviewers like papers that go along with traditional (theirs) approaches in the field and that they want their work cited, vs. only 22% who feel that reviewers like radically novel ideas or approaches (question 4.5). There is a lukewarm feeling towards the quality of the reviews: 51% agree that "reviewers' comments help to improve the paper a lot", while 43% also find that "reviewers' comments help improve the research".

The average time from initial submission to printing, estimated by authors for their own articles of the past three years, was 9.1 months (question 4.6). A quick calculation from submission and publication figures posted on the Web site of the ASCE Journal of Computing in Civil Engineering gave an average of 9.6 months (for the 19 articles of the 1999 volume, excluding special issues, for which the month of submission was stated). Similar figures could probably be obtained for the majority of journals included in the survey but involves quite a bit of work and would in many cases require access to the paper issues. The average for articles in the Electronic Journal of Information Technology in Construction is 4.5 months, which is to be expected since papers can be published straight away once they have passed the review and editing stage.

The reasons for writing conference papers (question 4.7) are similar to those writing journal papers but the most important one is "to get the immediate feedback, discussion and contacts based on the presentation" (average score 4.3). To 76% "spending some time near a beach" is not important. If the respondents have been truthful in answering this question, then conference venues should move to campus environments or large international airports.

In the questionnaire respondents were asked to rate "relatively how much credit do they get for the publishing in the different types of media" (question 4.8). They were asked to rate the credit on a scale from 1 to 10 in the academic credits. On average, there is an 8 points vs. 3 points ratio for publishing in the best journal vs. at the most obscure conference. Electronic journals received about 5 points, which is less than conference proceedings published as a bound book with page numbers.

8. VIEWS ON ELECTRONIC PUBLISHING

Particularly the students and the professors found it important that electronic publications are peer reviewed (even more so in the construction management field) - on average 69% find peer review important or very important (question 5.1). 75% find it important "that the papers should be available quickly on the Web, not bothering delays [v1]of formal publishing procedures". The questionnaire failed to point out that peer review is part of such a formal publishing procedure. All except the professors find the "quick availability" more important than peer review. Other important features of electronic journals are email alerting services and multimedia attachments.

When it comes to the format of electronic publications (question 5.2), fast access, full text available in any HTML browser and a possibility to print on paper are important or crucial to at least 75% of the respondents. The attributes not deemed important are professional graphics design, many hyperlinks, availability in printed format and particularly availability on a CD-ROM.

A strong majority (67%) believes that papers on the Web are more likely to generate personal contacts and that they will be read by more people (59%) than printed articles. The opinions are split on the controversial statement that "authors have a moral right to post copies of their own publications on their department's Web site, despite possible breaches of copyright" (39% agree, 26% disagree, others have no strong opinions) (question 5.3).

There is much support for a scenario of free electronic journals, where the costs would be covered by for instance professional societies or university libraries, rather than electronic journals accessible only by traditional paid subscription or site licensing (question 5.4). The options "Professional societies, through own funding or external grants" (3.7) and "University libraries, enlarging their role from archiving to publishing, using public funding made available through decreasing costs of paper archiving" (3.9) received very high

support , whereas "Readers, by subscription" (2.6) and "Readers, pay per view" (2.4) were much less popular. The option of author charges was ruled out (1.7).

9. DISCUSSION

The authors are well aware of the limitations of the particular questionnaire method used. In an ideal world we should first have identified the relevant target population of researchers rather exactly and then either sent a questionnaire to all of them or to a statistical sample. Also phone interviews with rather few questions would probably have provided results which are more representative for the whole population, since it is more difficult to avoid answering a phone interview than an anonymous email or letter. Techniques such as the ones outlined above were in fact used by the research team of the first author in the IT-barometer study (Howard et al., 1998), where the usage of IT in the Swedish Construction Industry was studied. The costs of that survey were, however, in the order of 50000 Euros and there was, despite all precautions, a strong suspicion that those members in the studied population who had a positive attitude to IT responded more eagerly to the study.

For cost reasons doing this survey in such a way was out of the question. Approaching the potential respondents by email was very inexpensive, and several existing email lists (i.e. CNBR, CIB W78), were used, the union of which covers the intended research community reasonably well. Using a Web interface for obtaining the answers, rather than a printed form, dramatically reduced the manual work needed to handle the raw data.

Due to this process the results should be interpreted with great caution. There is a high likelihood that researchers who use the Internet a lot and who have a positive attitude to electronic publishing have answered more eagerly than others. Some of the results can, nevertheless, be compared with earlier published results, in particular those reported by Tenopir and King (1998) in an overview article collecting data from several earlier studies and sources.

According to Tenopir and King the average number of scientific articles (authored or co-authored) per university scientist has increased from about one in 1977 to 2.1 in 1995. This can be compared to the figure of 1.6 of this survey. According to Tenopir and King scientists at the University of Tennessee read 188 scholarly articles per year (in 1990-93) which is a higher figure than the 107 of this survey. They also report that university scientists spent an average 182 hours per year reading scholarly articles, whereas the corresponding figures for non-university scientists was only 68 hours (figures for 1990-93).

A very interesting figure quoted by Tenopir and King is the average number of readers of a full text of a scholarly article for nine sampled fields of science - between 500 and 1500. Unfortunately this survey provides no means for getting comparable figures for our domains. For paper-based journals getting data about the number of subscribers to journals helps, but doesn't tell much about the readership of individual published articles, which can vary a lot. Also there may be several readers, or in some cases null readers to library journal copies. One of the positive things about information on the Web is that it is easy to check the number of accesses to individual pages. Also there should be an almost one to one correspondence between the number of accesses and readings. As an example, the average number of accesses to each abstract of an article published in the first four volumes of the Electronic Journal of Information Technology in Construction was 1074, to the full-length HTML versions 770 and to the PDF files 582. Even taking into account possible hits by Web search engines, assuming a readership of at least 500 per article seems reasonable. Looking at subscription bases and readership of journals in our domain would constitute an interesting follow-up direction for research.

Finally Tenopir and King provide data on the information-seeking pattern of scientists surveyed a number of times between 1977 and 1998. Most of the figures describe the situation before the proliferation of the World Wide Web. According to them, the most common way for scientists to find articles to read is by browsing paper material that comes their way via subscriptions, or are located in the departmental library etc. (50-72% depending on the survey). The second most common route is by being alerted by colleagues (10-18%). Citations in other works that trigger the interest accounted for only 6-13 %, depending on the survey. On-line searching in bibliographic databases accounted for between 1-14% and was clearly growing in the 1990s. These figures are not directly comparable to the figures from this survey because we asked people to grade the relative importance of these different routes rather than percentages. Nevertheless this is an area where Web technology is starting to have a very important impact. It is, for instance, becoming much easier to quickly follow up an interesting

reference if a URL reference is provided. Even if the reference is in a paper version and lacks a URL, one can always try keying in the title of a paper into a search engine!

10. CONCLUSIONS

All in all this survey has hopefully provided a reasonably reliable snapshot of the situation in the very beginning of the 21st century, looked at from the viewpoint of the readers and authors of papers in two narrow scholarly domains. It would be useful to follow up by a more thorough study of the "supply side" of the equation, by looking at how well the existing journals in the domain function, for instance by benchmarking them against journals and pre-print archives in other scholarly domains.

Our own subjective impressions are that the construction management community, which has a longer history than construction IT, has achieved quite a stable situation where a couple of paper-based journals have reached a substantial market share of the high-quality submissions and have a reasonable readership, making it worthwhile to subscribe to them. How that situation may become destabilised by the Web remains to be seen. As our survey showed, researchers in construction management are more conservative and are not eager users of the Internet for retrieving scientific information as are the construction IT research community.

As to the construction IT community we believe that there are currently too many and too small journals. Most of the journals have been founded during the 1990's and are struggling to survive. Competition for submissions is fierce and has led to practices that tend to lower the scientific standard of articles and to prolong the waiting time for publication. The idea of special issues managed by guest editors is as such not bad, but leads to very long waiting times for those authors who deliver rapidly. A "malpractice", which has become popular recently with some journals, is to publish special issues related to particular conferences, where conference papers are almost published verbatim in the journal issue. This is a practice that in particular leads to papers of dubious scientific quality being accepted for publication. Furthermore it is difficult to see the point in having papers which already have been published in printed conference proceedings being duplicated in scientific journals which are equally difficult or expensive to get hold of (there would be slightly more justification for publication in a freely available Web journal, if the conference doesn't offer fully electronic proceedings!). To quote the organiser of one of the major construction IT conferences of this year:

> *"there is a considerable overlap between journals/conferences proceedings that doesn't justify the expenditure of buying/subscribing to many journals. ………. My feeling is that not all published articles are original papers. Three journals approached me in publishing a special issue of selected CIT2000 papers which I think describes the situation very clearly" (Gudnasson, 2000).*

11. ACKNOWLEDGEMENTS

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APPENDIX 1:

Readers are invited to examine the questionnaire on the Web, as available at:

http://itc.fgg.uni-lj.si/survey/form.htm

APPENDIX 2:

Readers are invited to explore and query the results on the Web as available at:

http://itc.fgg.uni-lj.si/survey/results/show.htm

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[v1]Was the survey phrased this way or is this an answer given, If an answer it should read "and do not want the delays….".