1.1 Actors in the publishing process

All the major "players" in the scientific publishing process are currently faced with a quickly changing environment. <u>Readers</u> 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. <u>Authors</u> are faced with the dilemma of choosing in which type of journal to publish their results. 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 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. Or should they simply place their work on the Web so that it is found by new researchers using the Web as their main information source. <u>Publishers</u> have to make choices about whether to publish full text on the web in addition to the printed version, and if so if they should offer a screen readable (HTML) version or a printable (PDF) version or both. A crucial question 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 pass word protection or site licensing to universities. <u>Libraries</u> 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.

1.2 The general situation of scientific publishing

Since the WWW is providing a superb 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 98). 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 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 contains some interesting data. 61% of respondents felt that electronic journals/trade magazines are easy to use/user friendly, but 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 that 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".

1.3 Scientific publishing in construction management and construction IT

Electronic journals have been founded also in the domain of civil engineering research, with moderate success. In the research reported in this paper 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" as well as on more objective data collected 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 a lot of 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.

The efficiency of the scientific publishing process in our domain is not a trivial issue. Most of us spend around one third of our 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 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 e-Print archive 1999) processes about 20000 papers per year, at an estimated cost of 5 US $ per paper. Even taking into account the minimal user interface it offers and the lack of peer review, this figure should be compared to the 4000 US $ per paper (Odlyzko 1998) quoted as the publishers revenue, and thus equal to the publishers costs + overhead, for an average paper based journal!

2. THE SURVEY – METHOD AND RESPONSE

The first phase of this research was an extensive survey of our collegues, readers and authors of journal 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 cases studies of individual journals and conferences.

The publication and reading of scientific journal articles, cannot be studied in isolation, since it belongs to the larger context of how scientist acquire the data and knowledge that is used as an "input" into 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 listening to conference presentations to informal email exchange and visits to construction sites, have also been included in the survey.

The survey is interesting since it looks at the scientific publishing process at an intermediate level, in one particular scientific community as a whole, rather than concentrating on the case

study of one singe journal or looking at scientific publishing in general. The survey did not target the information exchange between research and practice.

The questions 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 do people follow, what conferences they go to, how much 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. Most questions demanded an answer 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 numbers (e.g. how many papers do you read per year). An average respondent took 2 minutes to fill in the form.

The form was placed on the Web. It is still at http://itc.fgg.uni-l.si/survey/. Visitors can also explore the results and perform some elementary statistical analysis on-line.

The presented results are based on the 236 responses accumulated between 14th of February and 14th of March 2000. The survey was announced electronically to mailing lists subscribed by academics and researchers in the AEC fields and reached an estimated 3000 persons. Figure 1 shows some basic demographics figures.
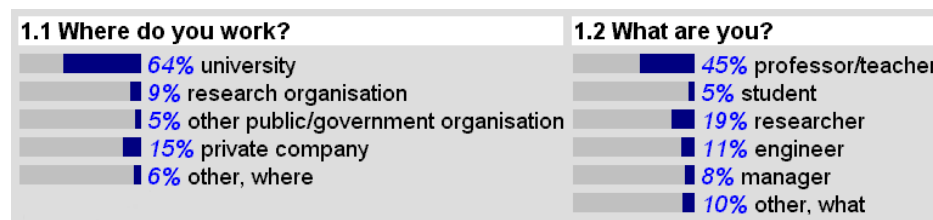

1.1 Where do you work?	1.2 What are you?
64% university	45% professor/teacher
9% research organisation	5% student
5% other public/government organisation	19% researcher
15% private company	11% engineer
6% other, where	8% manager
	10% other, what

Figure 1: Some demographics of the survey – this figure is dumped from the Web where users can explore the survey interactively.

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).

2.1 Reading habits

The survey showed that personal discussions are the most important source where we learn "about what is going on and should be of relevance" (3.9 on 1-5 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 thing on the Web is a journal article, report, or book. The relatively least utilised sources are mailing lists and workshop presentations.
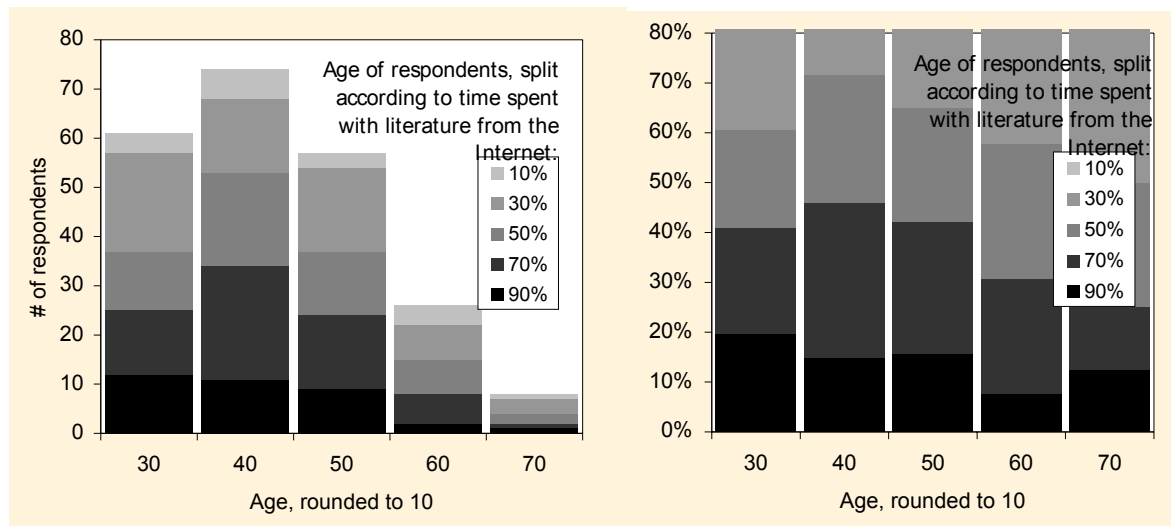
Figure 2: Age vs. the use of the Internet. Note that the heavy use of the internet drops with age, however the population from 35-45 uses the Internet relatively more than younger or older colleagues.

To "identify or find particular interesting items worth reading" 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 unimportant 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 preference for the just-in-time search in the readily available (references in other publications) or free (Web) resources. According to the answers, just-in-case browsing is somehow more important to the professors. This might be explained by the fact that professors through their network and connections receive much more free paper copies of material which they browse through compared to junior researchers and Ph.D. students. Their function is also to keep a broad perspective that they can maintain through the just in case browsing.

The interesting publications, not readily available, are most often retrieved by downloading them for free from the authors (3.9) or some organisation's website (3.5). Going to the library to fetch a publication or ordering it through a library services is nearly a whole level less important (3.1). There is a 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 Websites". Few 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. Others work quietly., It seems however, that those that 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 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 2). 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 for 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 reader". Apart from this there are no other significant correlations between this information and the views on electronic publishing.

Surprisingly, the professors use Internet more than the students (!). Heaviest users of the Internet are engineers and professors not working at a university (Figure 3). The Internet seems popular in environments where traditional paper publications are not available, difficult or too much trouble to get, and 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. Research and practice, however often found scientific articles "too academic or too long".
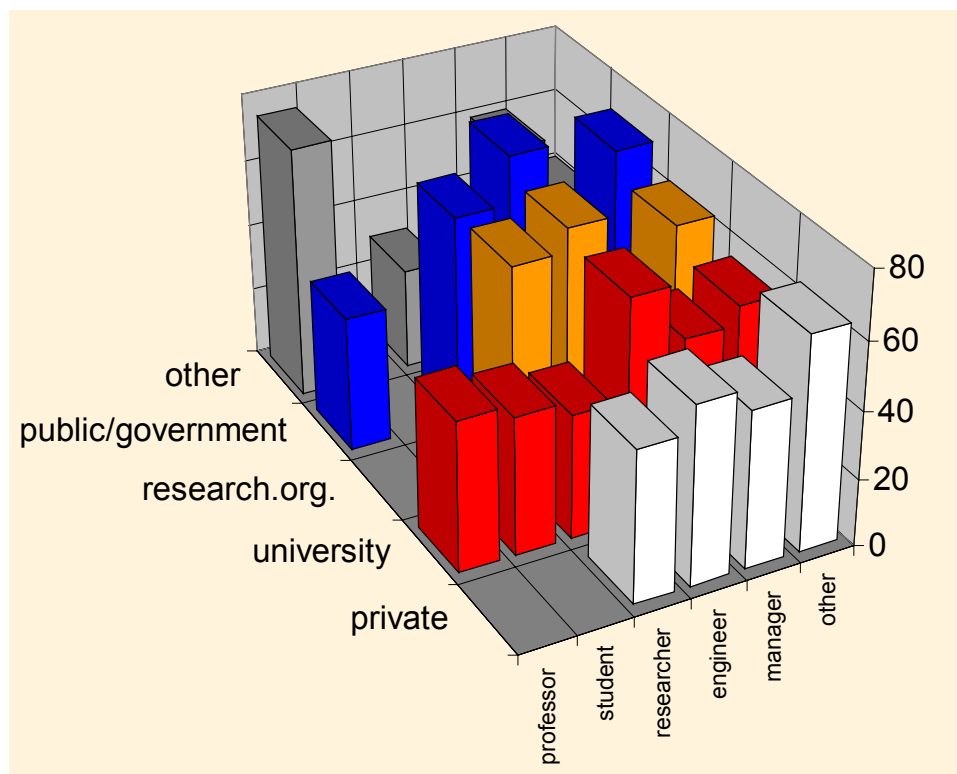

Figure 3: Part of time spent (in %) reading scientific information retrieved over the Internet rather than in paper form.

2.2   Readership of journals and visits to conferences

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

2.4   Construction Management and Economics
2.3   ASCE Journal of Management in Engineering

2.3   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 we "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 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) than the professors (103), students or engineers (78) and managers (8).

Professors seem to go to twice as many conferences as students (3.4 vs. 1.7). Construction management people travel more than the 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. One explanation could be that those who have the opportunity to travel to many conferences also can take the time needed to fill out forms. Heavy Internet users travel less.

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

2.3   Authoring of papers

Of the respondents, 85% have at some time during their career written a conference or journal paper". In the last three years they authored or co-authored 7.7 conference papers and 4.8 journal papers. This fits with the number of conferences they travelled to. There is a strong correlation between people writing any kind of publications. Those that publish more, publish more in any of the formats.

The important reasons for publishing are "to inform others about the work and results" (4.2) and to "gain credits for academic advancement" (3.6). When deciding about where to submit an article, 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 as authors!). This should, given the preferences for finding and retrieving the information, be essential if their aim is to actually inform others about the 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 are also indicative, for example:

> *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...*

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 agree that reviewers like radically novel ideas or approaches. 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 perceived time from submission to printing was 9.1 months. 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, excluding special issues, of the 1999 volume, for which figures were available. The average for articles in the Electronic Journal of Information Technology in Construction is 4.5 months. 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 reasons for writing conference papers 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, 84% agree or strongly agree). To 76% "spending some time near a beach" is not important. Conference venues should therefore move to campus environments or large international airports.

On average, there is a 8 points vs. 3 points ratio in the academic credits gained by publishing in the best journal vs. the most obscure conference. Electronic journals get 5 points, which less than conference proceedings published as a bound book with page numbers

2.4   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. 75% find it important "that the papers should be available quickly on the Web, not bothering delays 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, 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 not important attributes 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 own publications on the department's web site (despite possible breaches of copyright) (39% agree, 26% disagree, others have no strong opinions).

There is much support for a scenario of free electronic journals, where the costs would be covered by professional societies or university libraries, rather than electronic journals accessible only by traditional paid subscription. 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).

3. 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.

For cost reasons doing this survey in such a way was out of the question. Approaching the potential respondents by email was very cheap, and also there are several existing email lists (i.e. CNBR, CIB W78) 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; between 500 and 1500, of readings goings beyond the abstract of each scholarly article for nine sampled

fields of science. Unfortunately this survey provides no means for getting comparable figures for domains. It can, however, be noted that the average number of accesses to abstracts of articles for the first four volumes of the electronic journal of information technology in construction was 1074, to the 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 indicates a 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 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 altered by colleagues (10-18%). Citations in other works that trigger the interest account for only 6-13 %, depending on the survey. On-line searching in bibliographic data bases 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.

4. CONCLUSIONS

The survey 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. 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 preprint archives in other scholarly domains.

Our own subjective impressions are that the construction management community, which has a longer history, has achieved quite a stable situation where a couple of paper-based journals have reached a substantial market share and have a reasonable readership compared to scientific publishing more in general. There are two dominant journals, one favoured by Europeans the other by Americans, both of which publish a sufficient number of articles per year. 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 not yet as eager users of the Internet for retrieving scientific information as construction IT researchers.

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. They struggle, because readers, having many free resources easily available on the Internet, find subscribing to, or even fetching printed copy from a library, very cumbersome.

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 that 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 as such published 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!).

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