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Open access publishing in Finland: Discipline specific publishing patterns in biomedicine and economics

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Abstract

Open access publishing strategies have traditionally been directed towards what has been regarded as a homogenous scientific community of universities, researchers and libraries. However, discipline specific practices in communication and publishing strategies are prevailing in different scientific areas. In this study we, argue that discipline specific publishing patterns may affect the ways that open access strategies can be adopted in different scientific areas. We characterise and identify incentives for publishing open access into factors depending mostly on the social environment and factors mostly depending on personal factors of the researcher. In the case study comparing the field of biomedicine and economics and business administration we were able to find out figures on the proportion, type and channel of open access publishing of scientific articles by Finnish researchers in economics and medicine.

Keywords: open access publishing, publishing patterns, medicine, economics

1 Introduction

By open access we define that the user of a scientific publication (thesis, referee article or research paper) is granted free access to the text and can print it out and distribute it for non-commercial purposes. Open access can be seen as a movement where the initiative comes from researchers and librarians in universities and resembles the open source movement in computer software programming, see for example (Szczepanska, Bergqvist and Ljungberg 2003).

Subject-specific repositories for the free distribution of research results have emerged in research areas where traditions for the exchange of preprints have existed prior to the Internet and where the speed of publication is an essential factor (Kling and McKim, 2000). For example in economics the circulation of working papers has a long tradition and since 1998 also resulting in the digital library RePEc (Research Papers in Economics).

As an alternative to traditional subscription-based journals open access scientific journals have emerged since the beginning of 1990's. An open access journal is defined as a journal that distributes its content free of charge to the user. There are several business models for open access journals and so called hybrid journals giving delayed open access to content as described in Hedlund, Gustavfsson and Björk (2004). According to the directory of open access journals (DOAJ) there are slightly more than 2000 peer-reviewed journals listed in the directory in February 2006.

One of the main actors in the open access movement in biomedicine has been the National Institute of Health (NIH) in the USA. Its official policy towards open access is supportive, and from May 2005 NIH has requested and strongly encouraged all researchers funded by NIH to make final manuscripts available to other researchers and to the public through NIH National Library of Medicine's (NLM) PubMed Central (PMC).

From the earliest days of the web, individual researchers have distributed copies of their own publications on their personal homepage or the homepage of the research group. Even though the number of this kind of self-publishing or self-archiving is not known, this probably is the most common open access channel today. Besides open access journals, subject specific repositories and self-archiving, open access is also maintained by

universities and their libraries in the form of institutional archives. The increasing interest in recent years in institutional archives brings a more systematic and long-term commitment to this activity.
In the proposed paper, which is an expansion and further development of an earlier study by the same authors (Hedlund & Roos 2005) we start by outlining the field differences in scientific publishing and communication in earlier literature and from that we draw implications to open access publishing behaviour. In the following sections we describe the pre-requisites and present state for open access publishing regarding scientific articles in biomedicine and economics particularly in Finland. We look at the present systems (institutional archives, subject based archives and open access journals) and recent recommendations from officials. The author's incentives to publish is to disseminate the research results to a large audience but also to gain reputation among his colleagues by publishing in high-class journals, journals that are normally under high subscription fees.
The objective of the empirical study was to find out figures on the proportion, type and channel of open access publishing of scientific articles by Finnish researchers in economics and medicine. This can be as publications in open access journals or as secondary publications in institutional archives, subject-based repositories or services. This was done as a case study comparing research articles in biomedicine and economics.

2 Field differences in scientific communication and publishing patterns

Open Access publishing is in the official declarations and statements mostly directed to one single academic community of researchers, institutions and libraries. However, research reports and scientific articles give a more differentiated view of the scientific fields regarding scientific communication. Kling and McKim (2000) state that there is a high likelihood that field differences in communication patterns and the use and meaning given to different media and forums will persist also in the electronic age. Fry and Talja (2004) point out the importance of the overall context of domain differences in studies on use of scientific journal articles. Domain differences are seldom probed in debt and this can be seen as a common shortcoming in research questions on user habits, for example in questions like "when do researchers prefer electronic to paper formats". Fry and Talja also suggest that Whitley's theory of the social organisation of scholarly fields is useful as an exploratory model of e-journal use in different disciplines. The model can probably also be used to describe publishing patterns in scientific fields even though e-journal use and publishing patterns do not coincide in all aspects. Björk and Turk (2000) carried out a survey on e-journals use and publishing patterns within the community of construction engineers. Their results show that researchers like to retrieve publications directly from the web open access but the main criteria for choosing where to publish are academic status of the journal and relevant readership.
Whitley (1984) argues that scientific disciplines can be understood in similar ways as work organisation. The differences in scientific fields can be characterised in terms of two dimensions: *degree of mutual dependence* and *degree of task uncertainty*. The concept mutual dependence is associated with the degree of dependence between scientists, or particular groups or colleagues to make a proper contribution to collective goals. The researcher wants to increase his/her reputation among fellow scientists or colleagues. Two analytically distinct aspects to mutual dependence are made: the degree of functional dependence and the degree of strategic dependence. The first aspect refers to the extent to which researchers have to use specific results, ideas and procedures of scientists in the field to make claims on giving competent contributions. The second refers to the extent to which researchers have to convince the scientific field of the significance and importance of the research problems and research approaches presented (Ibid. p. 88). The concept degree of task uncertainty is associated to differences in patterns of work organisation and control and varies in relation to changing contextual factors. Whitley finds two major aspects: technical task uncertainty and strategic task uncertainty. The first refers to the "visibility, uniformity and stability of task outcomes" while the second refers to the "uniformity, stability and integration" of research strategies and goals (Ibid. p. 148). The high level of task uncertainty leads to greater personal direct control of research and is associated with theoretical diversity. Especially high level of technical task uncertainty limits the technical control of empirical phenomena and makes the results more difficult to interpret and give way to alternative views and difficulties in coordination (Ibid. p. 148). Whitley's example for the type of scientific field with high degree of technical task uncertainty and low degree of strategic task uncertainty is the field of Economics since 1870.
Whitley's taxonomy of scientific field differences can be concretised to the fact that when the degree of mutual dependence increases the ways of scientific communication become more controlled and the competition increases. Citation patterns become very important in a field with high mutual dependence. This fact may affect publishing patterns to be more restricted and standardised. Publishing in highly respected journals with high impact factors and high rank becomes important.

In fields with high degree of task uncertainty publishing patterns might be more uncontrolled but still in the case of economics where the problems and goals are restricted and tightly structured the visibility and communication of scientific results in an early stage is important. The distribution of working paper might be an indication of this fact.
From the Finnish study by Ursin (2004, 28) on characteristics of medical research group we find that the increased demands from society and officials on productivity and accountability is probably a factor affecting publishing of research. Also the visibility and reputation of the researcher are important personal factors. When reviewing studies of collaborative research among scientists Ursin (2004, 28) picks up factors that have been found in earlier studies to motivate researchers to co-operate. Among these, the increased demands from society and officials on productivity and accountability are probably factors affecting also publishing of research. Also the visibility and reputation of the researcher are important personal factors.
Regarding open access publishing, the CUL Open Access Publishing Task Force Report (2004) stresses that there is no single academic community but multiple communities with various cultures and that this point is crucial when trying to organise and analyse academic interest in Open Access publishing.
Open access author behaviour has been studied probably most extensively by the CIBER research group in United Kingdom 2004-2005 (Nicholas & Rowlands 2005) Attitudes towards open access publishing was gathered in a world wide survey directed to authors publishing in peer-review journals indexed in ISI. One of the results was that open access is not a well known phenomenon among researchers in general, only 5% knew a lot of open access and 48% said they knew a little about it. However, there were several interesting points to be noted, younger authors and authors already publishing in open access journals are more positive than senior authors. There are also differences in geographical location; researchers in Western Europe and North America were least likely to have published in open access journals while researchers from South America and Asia have most experience in publishing in open access journals. Also differences in attitudes between scientific disciplines could be seen. Respondents from immunology and material sciences and medicine thought that authors will publish more in open access journals in the future. Authors from chemistry and economics were of the opinion that open access gives less choice. The opposite opinion was prevailing in neuroscience, immunology and biochemistry.
Studies on authors attitudes towards open access publishing have also been carried out by Swan and Brown (2004), and Schroter, Tite and Smith (2005). The results from the first study indicate that open access is no longer an unfamiliar concept among researchers and that self-archiving is also increasing, although the awareness of the archiving possibilities is still low. The latter study explores authors' attitudes towards journals using author charges and is conducted among British Medical Journal authors. The results from the study were that the perceived journal quality is more important than open access.
From the literature study on previous research we were able to characterise and identify incentives for publishing open access into factors depending mostly on the social environment and factors mostly depending on personal factors of the researcher.
Environmental or external factors:

- Policymaking, governmental policy in science and technology, policy of other funding bodies, interest groups and officials
- Increased demands of productivity and accountability
- Internationalisation and strong competition in the scientific field
- Geographic location
- Availability of subject based and institutional archives, open access journals
- The institutional policy to promote open access publishing
- Communication patterns of the scientific field, for example early adoption to new techniques

Personal factors:

- The importance of reputation and meriting as a researcher
- Speed of publication and visibility of research results
- Personal communication patterns and early adoption to new techniques
- Personal values

3 Open access initiatives in biomedicine and economics

One of the main actors in open access movement in biomedicine has been the National Institute of Health (NIH) in the USA. The mission of NIH is to disseminate new knowledge that will lead to better health for everyone. The primary mechanism for accomplishing this mission is the sharing of ideas, data and research findings. These mechanisms perfectly fit to the principles of open access. The main actor at NIH has been the former director Dr. Harold Varmus, who in May 1999 proposed that an electronic repository for all biomedical research

(called E-biomed, later PMC) should be established at the National Library of Medicine (Homan and Watson 2004, 83). The establishing process of the repository, the public discussion and the role of the main actors beside Dr. Varmus, namely the scientific societies, is described in an article by Kling et al (2004).
NIH supports the availability of research results in several ways. It has an official policy statement concerning public access of NIH-funded research results. From May 2005 NIH has requested and strongly encouraged all researchers funded by NIH to make final manuscripts available to other researchers and to the public through NIH National Library of Medicine's (NLM) PubMed Central (PMC).
According to an estimation made by Elias Zerhouni, the director of NIH, NIH funds at least ten percent of annual biomedical literature. This should mean a yearly addition of about 65000 articles to PubMed Central. (Zerhouni 2004 a).
In biomedicine there are two current, successful open access publishing models that provide immediate access to research articles. The first one is BioMed Central (BMC), a commercial publisher. The second one is Public Library of Science (PLoS), a non-profit organization which consists of an independent group of researchers, who have committed to providing free access to biomedical literature. Both of these publishers allow free access, while authors will be charged for publishing their articles. BMC and PLoS also submit all articles to PubMed Central. (Zerhouni 2004 b).
Both of these publishers have almost similar fee policies. There exists an article fee and a membership fee. Institutions can pay a certain sum of money in advance and get discount from the article fees. BMC allows new customers to join with quite a low institutional price but after a certain time the charge will be based on the amount of articles actually published in BMC and in most cases there is quite a big increase in the price. Finland has had a national license with BMC from the year 2004-2005. This was negotiated by FinElib, the National Electronic Library of Finland. Since that date (1.4.2004-30.9.2005) 58 open access articles have been published by Finnish researchers.
Research Papers in Economics (RePEc) is the largest digital library in the field of economics. It is a collaboration project involving volunteers from 53 countries. RePEc is a service provider of links to decentralised online material in the form of working paper series and journal articles in institutional archives. RePEc also collaborates with the database EconLit and the American Economic Association. It is to be noted that RePEc does not contain full text material only references to downloadable files. There are currently 1481 working paper series and 447 journals covered by RePEc, which means a volume of 170,000 working papers and 187,000 journal articles. The Swedish School of Economics and Business Administration registers its open access working paper series with RePEc. Today 20 working papers are listed from Hanken since 2003. There is a declining trend in number of papers 2003 (10), 2004 (6) and 2005 (4).

4 Methodology of the case study

The reference data on published articles for the empirical study on medicine was collected from research information registers for the years 2003-2004 from the National Public Health Institute (KTL) and from the Faculty of medicine at the University of Oulu (Oulu). The reference data for economics and business administration was collected from the Swedish School of Economics and Business Administration (Hanken). The chosen sample consisted of 464 (Table 1) articles in biomedicine and 130 in economics and business administration. Bibliographical information was collected from the reference lists or the subject based database PubMed Central. Open access journal titles were identified using DOAJ, BioMed Central and PubMed Central or in some cases the Ulrich's Periodical Directory of journals.

Table 1 Sample for the empirical study on open access research articles

Institution	Number of articles	Years
KTL	340 (170 + 170)	2003-2004
Oulu	124 (47 + 77)	2003-2004
Hanken	130 (63 + 70)	2003-2004

Google, and Google scholar, were used as search tools to find out about weather an article in the sample was available as secondary publications in open access format in for example personal or institutional web sites or archives. The general search engine Google was chosen because of its popularity among the public and the Google Scholar version because of its specialization on scientific material. It is popular among researchers to collect information about a researcher through his/her web page and to look up references directly from the web using a general search engine. The search criterion used in the study has been the full article title. In this case study only two search engines were used and we were aware that the result might differ if other search engines

or other search criteria, such as author or affiliation, had been used. However this study is not intended to show the complete coverage of possible ways to find an article online, rather to study the publishing patterns of a scientific field concerning open access.

5 The case study organisations

National Public Health Institute (KTL) is a research institute and an expert body under the Ministry of Social Affairs and Health. The aim of KTL is to promote the possibilities to a healthy life for the Finnish people. The functions of the institute are research, expert functions, health monitoring, public health services, educations and training, international collaboration, laboratory research and participating in the dissemination of health information and health education. KTL covers the public health field on a broad spectrum and creates synergy effects between research and public health functions. KTL's number of staff is over 900 of whom 360 are researchers. About 500 original scientific articles are published every year.
The University of Oulu is a multidisciplinary university in Northern Finland. The number of staff is 3100 and the number of students is over 15800. There are nine educational areas in the university organized in six faculties. The focus areas are Biotechnology, Information technology and Northern and Environmental issues. The faculty of Medicine is divided into 27 departments. The research in the faculty is concentrated in six main areas: cancer biology and cancer diseases, cardiovascular diseases, connective tissue research, cartilage and bone diseases.
The Swedish School of Economics and Business Administration (Hanken), founded in 1909, is an internationally accredited university in the field of economics and business administration, situated in Helsinki. There are seven departments, economics, marketing, finance, management and organization, business law, accounting and language and communication. The number of students is 2400 of which 200 are doctoral students, the number of faculty is 140.

6 Results

The publishing of scientific articles in the case organizations in open access journals is still rather low. The sample consists of only 7 articles in BioMed Central journals (author charges) 8 articles in medicine and 4 on economics and business administration in pure open access journals. PubMed Central provides access to 83 journal titles in many cases with delayed access.

Table 2 Open access articles according to type of journal publisher

Type of publisher	**KTL 2003**	**KTL 2004**	**Oulu 2003**	**Oulu 2004**	**Hanken 2003**	**Hanken 2004**
Society publ.	43	15	14	18		5
Commercial	10	12	3	1	5	12
BioMedCentral	1	6				
Other OA-journal	5	1		2	1	3
Total	59	34	17	21	6	20

The data on the percentage of articles found openly accessible on the Internet are presented in Table 2. As could be expected the percentage is varying a lot between the years. The percentage is 34 for KTL resp. 36 for Oulu in 2003. In 2004 the percentage drops, and is 20 for KTL and 28 for Oulu. The reason for the decrease in the percentage in 2004 could depend on the delayed access for some medical journals. The study was conducted in April – May 2005 and extended to Economics in autumn 2005. In 2003 the researchers at the Swedish School of Economics and Business Administration published 63 articles in referee journals and only 6 or 9,5 % were available open access. In 2004, 67 articles were published but now the percentage of open access had risen to 29. However, It is to be noted that in 2004, 4 referee articles were produced by the open access research group and these were available on the web site of the research group. The awareness of open access has also grown among the faculty of the school due to the research activities.

Table 3 Number of articles found on the Internet using standard search engines Google and Google scholar

		Number of articles	**Found on the Internet**	%
KTL	Original articles 2003	178	59	**34.14**
	Original articles 2004	178	34	**19.10**
University of Oulu	Original articles 2003	47	17	**36.17**
	Original articles 2004	77	21	**27.27**
Hanken	Original articles 2003	63	6	**9.5**
	Original articles 2004	67	20	**29.8**

In the study we wanted to categorise the article found openly accessible on Internet according to location. In Table 3 the type of web site (journal site, subject repository, institutional repository or personal or research group site) is presented. In medicine a majority of the articles found could be located to the journal page, in many cases with delayed open access. In economics and business administration most open access articles found on the web were secondary publications in preprint or post print form in institutional archives or personal home pages.

Table 4 Article information according to the location of the open access version

Article information	KTL 2003	KTL 2004	Oulu 2003	Oulu 2004	Hanken 2003	Hanken 2004
Location						
Journal page	43	27	17	20	1	3
PubMedCentral	4	1				
Ingenta connect	1	3				1
Soc. Sc. Res. Net					1	
Institutional archive/ WP archive	11	3		1	4	8
Personal home page						8
Total	59	34	17	21	6	20

7 Discussion

On a general level we can say that biomedicine is a scientific field where publishing of research results in the form of scientific articles is the prevailing standard procedure accepted by the community. Different business models even page charges are tolerated in biomedical sciences because of the desire to publish in the most prestigious journals. It is probably not a coincidence that the business model author/article charges combined with open access instead of subscriptions, used by the publisher BioMed Center, was applied in the medical sciences. The large number of society publishers is also a specific characteristic of the academic field. Their important and sometimes dual role in the e-publishing debate was however pointed out already in the study by Kling, Spector and Fortuna (2004).

The recommendations from NIH was in the end to recommend scientific journals to open up the content at least after a delay of 6 months to one year is probably the main reason that the large proportion of society publishers put up their content in PubMed Central. The role of NIH and PMC is important. From the KTL's open access publications, 35 % in 2003 and 45 % in 2004 were available via PMC.

We can see a growing rate of publishing in BioMed Central journals on the whole in KTL and Oulu. National Public Health Institute (KTL) like some universities in Finland joined BMC already a few years earlier than the national license was signed and KTL's researchers have published 29 research articles during the years 2002-2005 (Nov.) in BMC. The University of Oulu published 12 research articles in BMC during the same period, the University of Kuopio 23 articles, the University of Tampere 24 articles and the University of Helsinki 59 articles. The amount of published articles has risen substantially in 2005. It seems that at least in this respect some of the OA -titles have gained a quite stable or even growing position in the market.

We argue that the most important factors in the social environments promoting open access publishing in medicine have been the political and practical initiatives made by National Institute of Health and the National Library of Medicine. The importance of the subject based open archive, PubMed Central cannot be overlooked. Successful new business model evolved by BMC and support of the usage of that channel on national and institutional level has also had an impact to publishing patterns.

Regarding the publishing patterns in Economics and business administration journal articles are becoming more and more the prevailing standard for personal meriting of researchers in the community. However, in the field of economics there is a tendency that the time from submission to acceptance and finally publishing in referee journals is very long. The tradition of publishing working papers in national and international working paper series is still prevailing as an important publishing channel.

In economics and business administration no such discipline specific international initiatives for open access as by NIH in medicine has been made. However, the tradition of distributing working and research papers among colleagues has been successfully adapted to the digital age by the foundation of the digital library RePEc. In economics and its close discipline finance the major reference database is EconLit produced by the American Economic Association.

At Hanken we can see a growing interest in publishing in international referee journals due to organisational incentives. Impact factors as a ranking factor of publications has been used at Hanken in the last two years. At the same time the number of open access working papers and research papers in the publication series of the school has become less important. The library has for several years been cooperating with RePEC for distribution of links to the publication series of the school.

In Finland the minister of education has appointed a committee to develop recommendations for an open access policy in 2004. The report was published in March 2005. What the impact of the Finnish open access recommendations will have in the future is not clear but at least the recommendations concerning the building of institutional archives in universities and research institutes seems to interest at least the libraries. Weather the policy of the organizations will be that uploading of articles to the archives is mandatory to the researchers is yet to be seen. In this respect the attitude and policy of each university and research institute as well as the research funding bodies, especially the Academy of Finland are in the key position. The copyright policy of the publishing journals in the future and the researchers' possibility to retain the right to put up a copy of the article in an institutional archive are also crucial factors to the success of filling the archives.

The status or ranking in the research community might also be based on publishing in particularly, "the right" journals. It could be possible that it also benefits researchers' organizations, because the competence of the researchers indicates the quality of the whole organization.

One important actor in medical research is industry. According to Richard Smith, the former editor- in-chief of British Medical Journal, approximately 70 % of all published drug studies are financed by the drug industry (Järvi 2005, 13). However, we will not in this study take a stand to weather open access is profitable to the medical industry.

Regarding the personal factors affecting publishing patterns of the researcher we cannot on the basis of the limited case draw any conclusions. However, we can argue that the trend in medical science that impact factors are important also prevails in open access publishing. At least in biomedical research institutes like KTL, the

researchers want to publish original articles in journals that have as high impact factor as possible. It seems that it is the main criteria for the choice of journal. This is mainly because impact factor of journals and number of citations in articles are the main ways to evaluate the quality of research e.g. by the research financing institutes. The other reason for author's choice might be the speed of the publishing process. In certain circumstances speed of publishing can be even more important than impact factor. This speaks for online only and OA-publishing. The degree of internationalization in the field is indicated by the high number of co-authorship and the publishing language English.

Thomson ISI (Institute for Scientific Information) counts the impact factor of a few open access titles. The impact factors of BMC titles vary between 1 and 5.4 in 2004. Quite many of the BMC titles are competing very well with traditional journals, e.g. BMC Bioinformatics, ranked 6th (IF 5.4) in its category (total number of titles is 51, median IF 2,1) or Arthritis Research and Therapy (IF 4,5) ranked as 2nd in its category (total number of titles 22, median IF 1.6). Public Library of Science Biology is doing even better. It's IF is 13.8 and it is ranked as 8th in the large competing category of biochemistry and molecular biology with a total of 261 journals and median IF 2.3. (The impact factors are collected from ISI Journal Citation Reports on 13th of Nov 2005). These examples show that it can be expected even in the near future that traditional publishers might face more challenges in getting the best articles to their journals. Researchers might to a higher degree regard factors like visibility and speed of publishing as important to their choice of journal and this might increase publishing in highly ranked open access journals.

In this study we have looked at the publishing patterns regarding open access for two specific scientific field, biomedical research and economics and business administration in Finland. We have identified incentives to publish open access as environmental or external factors as well as personal factors. Due to the limitations of a small case study such as ours we can only indicate that the publishing patterns and scientific field differences are important when implementing open access initiatives and recommendations. We will continue to study more in debt the publishing patterns regarding open access in the future.

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