OPEN KNOWLEDGE RESOURCES FOR HIGHER EDUCATION: SCHOLARLY PUBLICATIONS, COURSE MATERIALS, ACADEMIC SOFTWARE

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Introduction

> *"Long ago we outsourced publishing to publishers. Now we need to take it back."*
> J. Robert Cook, Dean of the faculty, Cornell University

This paper will explain why electronic knowledge resources in academia cannot only be regarded as private commodities, but also as *public goods*. After sketching a concept of public goods for a post-national, global society, three types of electronic knowledge resources are distinguished: scholarly publications, course materials and academic software. With the help of practical examples, similarities between these resources are developed. Finally, it will be explained what advantages the status of public good for knowledge resources would have and how it could be achieved by the academic community.

1. Global public goods

"The public/private divide is traditionally understood in terms of state ownership." (Marginson 2004b, p. 1). In this notion, *public goods* are those owned and/or produced by the state. In contrast to that, *private* is every social formation apart from the state, e.g. ranging from market-oriented business to NGO, from civil society to family, etc. *Private goods*, in this understanding, are those produced by these non-state social formations. "However as noted, the equitation of public/private with state/non-state (or state/market) creates serious difficulties." (Marginson 2004b, p. 3). One problem is that the conception from traditional statist political philosophy focuses mainly on the mode of production (state/non-state), while it "is not sufficient to explain the social character of what is produced." This makes it difficult, for example, to describe positive or negative externalities of non-state activities, even if they touch the public interest. Another perhaps even more important problem lies in the fact that a statist approach cannot describe public goods on a global scale, since there is no global state. The concept can capture internationalisation and globalisation only as a phenomenon of private markets and/or private companies. As a result, international higher education is only understood as a *commercial* activity and treated respectively in the WTO/GATS process.

To overcome these limitations, Marginson (2004b, p.5) offers an alternative definition of public/private, which in its core is indifferent to the mode of production, focusing instead on other attributes. He draws from the classic economic concept of public goods, outlined by Samuelson (1954):

> *"I define public goods in higher education as goods that have a significant element of non-rivalry and/or non-excludability and goods that are made broadly available across populations. Goods without these attributes are private goods."* (Marginson, 2004b, p. 5)

The Challenge of eCompetence in Academic Staff Development, Mac Labhrainn, I., McDonald Legg, C., Schneckenberg, D., Wildt, J., Galway: CELT, 2006.

Goods (or services) are "non-rival", if people can use them without competition or mutual interference. They are non-exclusive, if their use or benefits are not confined to a limited number of people. This definition can be used in different geographic or socio-political dimensions, on a global or a meta-regional level (e.g. EU), on a national or local level, without changing its meaning. However, it might become necessary to specify which level one refers to, e.g. to a national or global public level, and whether public interest or public good.

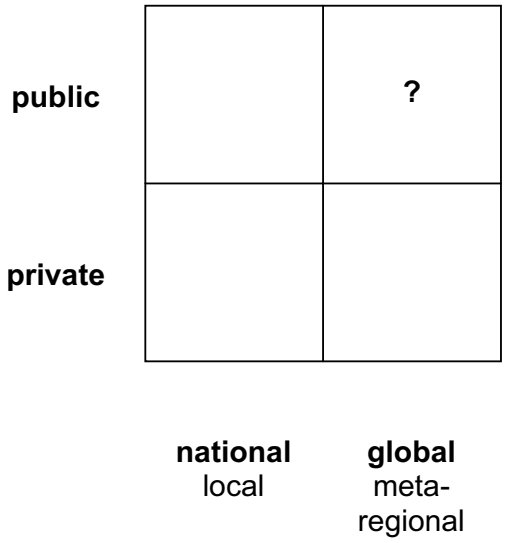

Figure 1: A lack of concepts for global public goods, based on Marginson 2004a.

In contrast both to the classical economic perspective and the statist perspective, Marginson (2004a, b) sees private/public neither as fixed, natural, nor as essential attributes, which have to exclude each other. Rather, he suggests that higher education produces a complex mix of public and private goods that might vary in time (2004a, p. 7). One can conclude that the specific mix is a matter of political choice and socio-economic convention.

Stiglitz (1999), who also uses non-rivalry and non-excludability as criteria for the definition of public goods, sees knowledge as one of the purest examples to fulfil these characteristics. Additionally, knowledge also most obviously qualifies as global public good, since most knowledge is universal in its nature. One of the few restrictions he makes lies in the fact that the "transmission" of knowledge might be charged for, since significant costs can be associated with this activity. However, in his opinion, these costs for transmission do not affect the public good nature of knowledge.

This is where my main line of argument begins. The transmission of knowledge very much depends on the form of its physical representation. Knowledge is bound in knowledge resources. Does the development of new ICTs and the resulting shift from analogue to digital knowledge resources change the economic nature of these resources?

2. Knowledge Resources: Private Commodities or Public Goods?

2.1 *Knowledge resources as private commodities*

The debate on possible economic models for the distribution of electronic knowledge resources predominantly focuses on revenues. The debate often tries to explore potential, new sources of revenue through commercial distribution of electronic resources, while the potential for cost

reductions are neglected. This perspective is based on a misconception of the new economy that the use of ICTs will automatically lead to commercialisation, even at higher education institutions. This assumption was justified with the wrong comparison between education systems and the entertainment industry. Eli Noam (1995, 1999), for example, reasoned that the invention of analogue recording technologies (disc, film, magnetic tape) had led to the industrialisation of the entertainment business, which previously was based on craftsmanship. As a result, huge international enterprises emerged, based on the profitable distribution of physical copies of recordings. This also led to a highly competitive star system, needing only a comparatively small number of prominent and commercially successful artists.

Noam transferred this image to the educational system in the digital age. Quoting from Michael Milliken, a former "junkbond king" at Wall Street involved in speculation scandals in the '80s, he stated that: "higher education is a trillion dollar business run by amateurs." No wonder that Noam only saw a "dim future" for universities, which are, in his opinion, still organised like a guild of craftsmen. Instead he predicted good prospects for organisations which try to learn from the procedures and business models of publishers and media companies.

Visions such as these, which are characteristic of the hype of the new economy, were used as an argument that ICT should be viewed as a means of generating profits for higher education institutions, and that only the most profitable higher education institutions would survive. As a result, higher education institutions changed their economic priorities. While in the past, institutions mainly focused on surviving with their budgets, trying to keep purchasing costs as low as possible, now the focus shifted towards profit orientation. If a university was involved in the production of digital knowledge resources, they restricted access to them, hoping that it might be exploitable economically. The misconception that digital knowledge resources in academia might turn into quick profit also led to huge stranded investments. One example for this is the *Fathom* project at Columbia University, which lost $25m in its attempt to sell learning materials for profit.

2.2 *Knowledge resources as public goods*

The hype of the new economy in the 1990's led many observers to the assumption that ICTs would fundamentally change the business models in research and higher education. They assumed that increased digitisation would automatically lead to commercialisation in academia.

At least with respect to knowledge resources, the business model of research and higher education is considerably different to other industries, e.g. the news and entertainment business, two segments which produce commodities for mass markets. Academic knowledge resources cannot be commercialised in the same way, since the respective clients for individual products are often highly specialised and context specific. Additionally, scholars and higher education institutions are the main producers, as well as the main consumers of academic knowledge resources.

Another characteristic of academic knowledge resources lies in the fact that they are normally not regarded as a direct source of income. This is different to the case of journalists or novelists, for example, who directly depend on the commercial distribution of their products. Scholars are normally paid for their work, which is teaching and doing research, not for the products they produce. From their perspective, their products are not-for-profit, since they normally do not receive any (or at most, only negligible) direct compensation for these products. Naturally, there exist some scholars, who receive royalties, but only in a few cases does this constitute a significant source of income. Normally, the dominant sources of income are salaries.

Higher education institutions and their members only receive negligible revenues from the commercial distribution of their own knowledge resources. On the other hand, they very much depend on access to other knowledge resources. Therefore, commercial distribution of knowledge resources can become a barrier for academic communication. Taking the systems of education and research as a whole, increased prices do generate more income, but rather higher costs. Prices for knowledge resources transform into costs for higher education institutions and into profits for vendors.

There exist a number of reasons why knowledge resources should be treated as public goods and why to support their free exchange. DiBona et al. (1999), mention two arguments: The free circulation of knowledge (via the free circulation of knowledge resources) can reduce the danger of parallel developments, which reduces the costs for the whole system. Additionally, the free circulation of all components in the development process of research (especially the theory, the research method and the results) is a requirement for the possibility of critique and efficient quality control. This publicity also is in the interest of the individual scholar, since personal performance becomes addressable and increases the reputation of the scholar in the respective scientific/research community. Indirectly, the publication, the dissemination of the results of one's work, is a requirement for the awarding of teaching positions or of the allocation of research funds. As a main indicator for employment and promotion in academic institutions, it also is a core requirement of academic careers.

These arguments for a free distribution apply at least to three types of academic knowledge resources: to scholarly publications, to learning materials and to academic software. For all three types, there exist examples, where the use of ICTs leads to a (re-)definition of knowledge resources as public goods.

3. Scholarly Publications

The business model for scholarly publications differs considerably from the model for commercial publications. Generally speaking, scholarly publications tend to be operated on a not-for-profit basis, since their producers normally do not receive financial compensation for their texts. The purest form with respect to this characterisation is the paper in a scientific journal. While the creators of for-profit publications (journalists, novelists, etc.) directly depend on the revenues for their texts, scientific authors do not receive any revenues for their papers. The reviewing of scientific journals, which is performed by scholars as well, is not paid either (Harnad 1999).

This business model is based on the institutional arrangement between the complementary parts of public universities and scientific/research journals. For the last few centuries, research has been performed by scholars who are predominantly employed at public universities. Individual scholars publish and review for free. They are paid for their research and their teaching, not for writing. Their motive is to contribute to the scientific debate and to gain reputation from the attention of their audience. Publications are part of their record of achievements and are an essential criterion for career steps like hiring or promotion. University staff are the main producers as well as the main consumers of scientific journals. Specialised journals for scientific communities or academic associations form the backbone of the scientific communication system. Their main function is to enable scientific communication beyond the borders of the local institution and to safeguard scientific quality (Stichweh 1984, p. 394 ff.).

The freedom to openly exchange ideas and knowledge is the basis of scientific communication. To put all parts of scientific knowledge (the hypothesis, the test conditions, the results) in the public domain is a core requirement. Since the use of scientific knowledge represented in a scientific publication is not competitive or "nonrival" (its consumption by one scholar does not limit another scholar's access or benefit), scientific knowledge (and to a certain extent: scientific publication) qualifies as a public good.

Given these normative mechanisms, the system of scholarly communication has been experiencing three economic phases: the original state of greatest possible distance between scholarly publication and the market, the phase of increased commodification and the present counter-movement of de-commodification (Nentwich 2001). The first phase started with the foundation of university presses (e.g. Oxford in the late 15th century) and of academic journals by scholarly associations (e.g. Académie Française, Royal Society in the 17th century). Since market mechanisms did not provide sufficient profit for commercial publishers, scholarly publications had to be subsidised by universities, associations or governments to advance scientific communication. In those cases where private

companies were involved, prices for scientific publications, in principle, covered the transaction costs for printing and distribution of physical copies only.

During the 1960s, scientific publishing companies started to merge on a global scale, to change their pricing policies and to become increasingly restrictive in their copyright management, stripping authors from most of their claims. While the actual transaction costs for print and distribution declined, prices for scholarly publications, especially for journals, escalated. According to statistics from the *Association of Research Libraries* (ARL) (Kyrillidou und Young 2004), between 1986 and 2001 the average annual increase of journal prices was 8.5%, compared to 3.3% annual increase of the Consumer Price Index (CPI). During this 15-year interval, the overall increase of serial unit costs was 215%, compared to 68% increase of monograph unit costs, or to 62% increase of the CPI. As Edwards and Shulenburger (2003) put it, "there are powerful reasons for believing that high and rising prices are due not to costs, but rather to the combination of highly inelastic demand and suppliers' substantial market power." Scholars who want to keep abreast of the latest developments in their field cannot substitute expensive top-tier journals by lower priced alternatives. The result is a reduced variety of consumed publications. ARL statistics report a decline of 5% in serial subscriptions and of 9% of monograph purchases during the mentioned 15 year period. While this mechanism narrows the focus on established research approaches, the publication of alternative perspectives and innovative approaches becomes more difficult. Since the entry of commercial publishers, universities have spent more money for scholarly publications and have received less intellectual capital, less value for money. Due to this market failure, additional public expenditures for a public good have been absorbed as private profits.

According to Nentwich (2001), the reactions to this general crisis of scholarly journals and book publications have initiated a shift to a third phase, characterised as a de-commodification of scholarly publications. Apart from more traditional strategies, such as forming huge library coalitions to concentrate purchasing power towards commercial publishers, many strategies make innovative use of ICTs. New technologies reduce transaction costs for reproduction and distribution to a minimum. In principle, ICTs offer the opportunity to merge two formerly distinct processes, publishing and archiving, into one integrated activity. To put a document in an online repository is simultaneously a step to publish it. In using this principle, several different approaches try to lever the efficiency gains of ICTs and to de-commodify scholarly publications. Without covering the full range of possibilities, we discuss three different types: self-archives, online-journals and pre-print-servers.

Many initiatives are experimenting with new opportunities for electronic self-publishing. In a bottom-up movement, individuals set up download pages and research institutes offer collections of their publications or set up electronic "working paper" series. In both cases, self-archives put online are a new tool to organise their own stock of electronic material for further use, a convenient form to raise one's profile and a valuable contribution to the research community. Due to the bottom-up approach, many of these electronic sources are heterogeneously structured, lacking properly coordinated infrastructure, which makes it difficult to access them and act in an unclear legal environment. To overcome these weaknesses, higher education institutions have started to strategically support their faculty and their subunits in their attempts to set up free online archives. For example, as part of its institutional library policy, the University of California set up the eScholarship Repository[1], a central location for faculty to deposit various forms of scholarly output. This repository also provides assistance in technical, bibliographic and legal issues connected to self-archiving and online publication. Discipline oriented meta-archives, such as Research Papers in Economics (RePEc)[2], are attempts to connect de-centrally located working paper series and to make them centrally searchable. Networks like the Open Archive Initiative (OAI)[3] or the Scholarly Publishing and Academic Resource Coalition (SPARC)[4] try to set common standards for meta-data descriptions of scholarly publications

[1] http://repositories.cdlib.org/escholarship/
[2] http://repec.org
[3] http://www.openarchives.org/
[4] http://www.arl.org/sparc/

and to distribute free archiving software to increase the inter-operability of institutional online archives.

As a medium of scholarly publication, journals are complementary to institutional archives. They do not collect papers produced at a single institution, but serve the communication in specialised research communities. Many publishers offer online versions of their printed series. Since the online journals have by far lower transaction costs than printed ones, it comes as no surprise that academics quite frequently found electronic-only journals as alternatives to commercial publications. Even if the quality can differ in the vast variety of E-journals, in principle, the same academic control mechanisms can be applied as in commercial print series. For example, the European Integration Online Papers (EioP)[5] uses the traditional peer review process to safeguard the journals' quality. However, given that ICTs reduce the costs of reproducing and disseminating, there still remain administrative costs, e.g. for managing the review process or for ensuring production standards. Especially for larger series, these costs cannot be covered by the work of volunteers only. The Public Library of Science (PLoS)[6], as a coalition of some ten-thousand research scientists in the fields of medicine and the life sciences, therefore developed a new publishing model for its own series. The main idea is to charge fees for publishing, which reflect the actual costs, and to provide open access for prospective readers. A similar approach is taken by BioMed Central[7], a commercial publisher whose business model is based on an article-processing charge of $525 (US) on all published research articles. In contrast to most other commercial publishers, BioMed Central builds its business model on providing open access publications only, leaving the copyright of all material with the authors.

A digital environment was also the pre-requisite for the evolution of a completely new way of publishing. Discipline specific pre-print archives are central servers which offer the opportunity to individually upload papers before they are published formally in a traditional journal. Since regular peer reviews, print and distribution procedures are very time consuming, pre-print archives, which circumvent these procedures, offer the advantage of greater speed in scholarly communication. The oldest and most prominent example is the physics server ArXiv[8], which first was set up at Los Alamos, but later was moved to Cornell University by its founder Paul Ginsberg. This server started as a tool to share pre-prints in theoretical high-energy physics only, but in the meantime became the principal 'library' for a large fraction of research literature in physics, computer sciences, astronomy and many mathematical specialisms. Today, more than half of all research articles in physics are posted to this server prior to their publication in conventional journals (PLoS 2005). Even if physics is an obvious front runner in the use of ICTs, these developments seem to be significant for other fields as well. Theoretically, some authors are already debating if pre-print archives only will complement the current journal system, or if they will replace it completely in the long run (Nentwich 2001, p. 27-28).

Another more recent, but remarkable, phenomenon is the digisation projects of existing scholarly publications, which are not initiated by academic institutions, but driven by industry, like the Google Print project[9] or the Yahoo Open Content Alliance[10]. Taking different approaches, both initiatives collaborate with universities in trying to digitise scholarly materials and making them freely available without cost for the user. However, they also raise concerns, e.g. with respect to copyrights, cultural dominance/diversity, or with respect to long term sustainability and dependence. Still, they also carry a huge potential for increasing the accessibility to scholarly publications.

These four types of ICT-based de-commodification of scholarly publications show some similarities. Academics and academic institutions have increasingly become active and are gaining more influence in the publishing process. Even more remarkable, is the general shift in the underlying funding

[5] http://eiop.or.at/eiop/
[6] http://www.plos.org/index.html
[7] http://www.biomedcentral.com
[8] http://arxiv.org
[9] http://books.google.com/
[10] http://opencontentalliance.org

models, from consumer based to producer based funding. Whilst the access to, and the use of, scholarly publications becomes free of charge, producers have to invest additional work and money in their publications. In an "economy of attention" (Franck 1999), this is an investment in the visibility and prestige of scholars and their institution. For scholarly communication in general, these models might reduce the costs and/or increase the efficiency of the whole system.

4. Course materials

Similar economic trends, as in the case of scholarly journals, can also be observed in the case of traditional textbooks and learning materials. As a report of the United States Government Accountability Office discovered, college students at 4-year public institutions spend an estimated average of about US $900 on texts per year, which is about a quarter of the annual costs for tuition and fees. At comparatively cheaper 2-year public institutions, average spending for books represents almost three-quarters of the cost of tuition. Over the last two decades, prices have risen at an average of 6 percent, twice the rate of annual inflation. Additionally, attempts to reduce costs through purchasing used books are undercut by reduced revision cycles, with more frequent newer editions (GAO 2005, p. 3-4).

On the other hand, many traditional higher education institutions make use of ICTs and are increasingly engaged in eLearning projects without aiming at a commodification of their educational services. They have to adapt to technological changes in their socio-economic environment (e.g. schools, employers, etc.) and aim both at efficiency gains and at qualitative improvements in teaching. For most traditional higher education institutions, eLearning does not mean pure distance learning, but a form of flexible or *blended learning* on the continuum between residential education and distance education.

A main difference between residential and distance education lies in their predominant form of operation. Residential education mainly relies on direct and synchronous interaction, while distance education traditionally is an asynchronous and materials based interaction. Blended learning merges both approaches and helps both residential and distance education to compensate their weaknesses with the help of ICTs. For traditional residential higher education institutions, it normally will be more important to focus on the provision of electronic course materials than to substitute direct interaction electronically.

The development of electronic course materials is expensive, but necessary, if universities want to make use of ICTs in higher education. And it is a new task many scholars are not used to. In the past, course materials were mainly produced for individual lectures or classes only and not regarded as very important or valuable by scholars. In many cases, course materials consisted of two sheets of paper: a syllabus and a reading list. Only in the case of large introductory classes for undergraduates was it more common to develop textbooks and sell them to students, a warmly welcomed additional (though limited) income for some professors.

Additionally, it makes sense to reflect on the special characteristics of courseware in higher education. Different to fictional books, music or films, where the entire piece of art can be attributed to one artist, course materials deal with scientific/specialist content. Rarely can this content be attributed to a single author. Normally course materials have to work as collections of ideas and resources, only a small part of which are from the lecturer. And, in contrast to a completed entertainment resource, it is comparatively more difficult to disseminate course materials on larger scales, since they always have to be adapted to the specific context of a teaching and grading situation. These are the reasons why it seems to be more appropriate to compare course materials with scholarly publications than with for-profit entertainment resources. This assumption is supported by the fact that there exist several examples of dissemination strategies, which very much resemble strategies for the dissemination of scholarly publications. We distinguish three models for the free distribution of course materials in

higher education: institutional archives, discipline driven networks and comprehensive brokerage platforms.

The most prominent example of an institutional online repository for course materials is MIT's Open CourseWare initiative[11]. In 2001, after a frustrating assessment of the options (there were none) to successfully commodify online courses, MIT promised to publish electronic materials of all its 2,000 courses online until 2007. By summer 2005, electronic materials of 1,250 courses were made available, the rest is to be posted during the coming years. All materials may be used under three conditions, which are regulated under a Creative Commons[12] license: commercial use without explicit permission is prohibited, formal credit must be given to MIT and the original author, and the distribution of derivative works is permitted only if shared alike, under an identical licence. In supporting its staff in issues of copyright and material production, MIT acts like a publisher. The materials themselves are not regarded to be fit for a wider audience, due to their often raw condition (e.g. transcripts of notes, basic data, etc.) and complex structure, but they are regarded to be sufficient for teaching qualified students (Drösser 2005). This is a remarkable phenomenon that should be emphasised in this context, because MIT is a *private* higher education institution, but still takes the lead in several open access initiatives (e.g. the Open Knowledge Initiative[13], the Sakai Project[14]), which create new public domains.

Another prominent example is the *Multimedia Educational Resource for Learning and Online Teaching* (MERLOT)[15]. In organisational terms, MERLOT is a collaborative effort of a consortium of more than 20 higher education systems and institutions. In functional terms, MERLOT provides the infrastructure to contribute, evaluate and freely distribute course materials for higher education. While being funded by the institutional partners, every individual can freely register and contribute. In principle, MERLOT aims at "aggregating and making freely accessible high quality online resources to improve learning and teaching within higher education" (Hanley 2000) and therefore is a free and open resource even if, in practice, limitations or fees may be associated with some course materials. MERLOT stores meta-data (e.g. descriptions, reviews, etc.) only, while the course materials themselves are located de-centrally and are the responsibility of the authors. To be posted at the MERLOT website, course materials have to pass a structured peer reviewing process that comprises three dimensions: quality of content, potential effectiveness as a teaching tool, and ease of use. Peer reviews are conducted by discipline-based editorial boards. Each institutional partner contributes both cash and support to advance the project. Apart from the goals to improve quality assurance of online materials and to increase the speed of development, cost reduction by "sharing" costs is one of the main motives for the participation in the consortium.

Another completely different approach is taken by Wikibooks[16], an initiative of the Wikimedia foundation. Similar to the way the famous Wikipedia encyclopedia is written – in a collaborative writing process of voluntary, individual contributors, who also can edit the contributions of others – Wikibooks aims at the production of textbooks for education. As a model, this approach is very different to traditional writing and editing procedures, but it carries much similarity with the collaborative production of code in open source software projects. However, at the present stage the project is too young and immature to assess its viability and potential.

In all these distribution models, course materials are acquiring a new importance unknown in the past. It is striking that making them public (through publishing) increases the value of course materials both for individuals and for institutions. Publication improves visibility and prestige and, especially when combined with a peer review process, improves the quality of the product as well. Since open educational resources became a trend of increasing significance, the OECD has acknowledged their

[11] http://ocw.mit.edu/index.html
[12] http://creativecommons.org/
[13] http://www.okiproject.org/
[14] http://sakaiproject.org/
[15] http://www.merlot.org/Home.po
[16] http://en.wikibooks.org/wiki/Wikibooks_portal

importance by commissioning a large survey, currently performed by the *Centre for Educational Research and Innovation* (CERI) (OECD/CERI 2005).

5. Software

While scholarly publications are a traditional resource of higher education institutions and course materials have recently gained new importance, academic software is a comparatively new resource for higher education. In our understanding, academic software does not only comprise research software (e.g. reference and bibliography tools, statistical software, etc.), but also educational (e.g. learning management and content management systems, collaboration software) and service oriented software (e.g. web-portal, E-portfolios, student registration, etc).

Academic software has become increasingly important for universities, since it accompanies and influences a growing range of individual and institutional activities. Therefore, it is necessary that software reflects both the procedures and the business models of academia. Commercial or proprietary software raise at least two intertwined problems. The first problem is the expenditure for software, costs which are hard to calculate and even more difficult to cover. For example, providers of learning management systems often combine low purchasing prices with licence models which additionally charge per user. Since the fee per user normally is fixed for a short time only, software companies can raise prices in the long run. In principle, they do not ask for a single payment that reflects development costs, but for a permanent fee for usage.

The other problem is the lack of technical transparency combined with strong dependency on the product in use. Private companies often have preferred proprietary data formats to make users dependent on their products. This has proven to be a big handicap for higher education institutions that very much rely on the cross-institutional exchange of scholarly publications, course materials and the related meta-data. In the meantime, several companies have reacted to the respective complaints of higher education institutions and started to increase the interoperability of their products. However, consumers still depend on the vendors, since the knowledge about proprietary software and formats is normally a well protected secret.

Open source software seems to be an answer to many of these problems. The key characteristic of open source products lies in the fact that their source code (an equivalent to a cooking recipe) is made public and freely accessible. Openness of the source code is a prerequisite for the opportunity to publicly test, vary and improve software. This procedure is very similar to the scientific method of knowledge production, where all essential steps (hypothesis, method of observation, results) have to be made transparent and open for critique. Open source software is published and discussed in specialised communities. These documented debates are an efficient tool to safeguard and raise quality. In the long run, they also can lead to the development of open standards, which in return can guide future software developments. Open source products can become public domain without necessarily being for free. In some cases, service providers charge for the dissemination of the software (e.g. via CD) or for its installation and maintenance. However, these charges are supposed to cover the respective costs and are not usage fees.

The open source idea is increasingly becoming popular in higher education. Especially for publicly funded higher education systems, it makes sense to invest in the development of academic software as a public good and as a public infrastructure. We will discuss three examples of major open source initiatives for academic software; one developed by an individual and supported by contributors, one driven by government and the other by a consortium of (partly private) universities.

Moodle[17] is an example of an open source product, which has been developed in a classical grassroots movement. Published in 2002, for the first time, by the Australian Martin Dougiamas, it soon became the most popular open source learning management system. According to its own information (Moodle 2006), there exist more than 10,800 installations in 152 countries, as well as language

[17] http://moodle.org

packages for 73 languages. The development of Moodle is based on the voluntary contribution of a worldwide community of developers. While the software is free, the Moodle service network offers commercial services, e.g. consultancy, installations and hosting.

As a contribution to the development of the eLearning infrastructure at schools and higher education institutions in the Federal State of North Rhine-Westphalia (Germany), the responsible ministry of education set up the CampusSource initiative[18]. The main goals are: to bring together the efforts of single universities, to trigger a cooperative process for the development of software systems and to provide the products freely as open source software for an international audience, regarding this as the appropriate form of scientific publication in this context. On the web-portal of the initiative a wide range of different products is collected, e.g. a learning management system, tools to produce or to organise learning materials, enterprise software for student administration, a web-base reference management system, etc.

A different approach was taken by the University of Michigan, Indiana University, MIT and Stanford. Together with the uPortal consortium, these universities founded the *Sakai Project*. They have contributed their already developed eLearning tools and integrated them in a joint technical framework to create a comprehensive, but modularised, software package. The package will contain software for an institutional web-portal, comprising all service and information systems, a complete learning management system, a tool to support research co-operation, a workflow engine and a clear technical framework for the development of additional software in the future. In designing tools for the easy migration of data from commercial learning management systems, such as Blackboard[19] or WebCT[20] (two companies, who recently merged), the Sakai Project not only invests in its own "openness", but also aggressively attacks the market position of vendors, which have been very successful so far. The first release of its open source software package took place in June 2004. The four universities in the core of the Sakai Project also agreed to simultaneously implement the software to make coordination easier. Additionally, an *Educational Partner Programme* was set up to involve further institutions in the project, because a successful and far reaching dissemination is regarded as a crucial factor for the sustainable implementation of technical standards and the long term success of the project.

5.1 *"Intellectual Property" vs. Service*

While in the past, academic knowledge resources have been bound to the medium of their physical representation (mainly paper), and the costs of knowledge resources, therefore, was linked to the costs for reproduction and distribution of physical copies (mainly books and journals), the continuing move towards digital resources loosens this connection. The non-material character of knowledge resources becomes more prominent, while the material part of the physical medium nearly vanishes.

These technological changes are accompanied by severe economic and legal consequences. While in the past, access to physical knowledge resources had to be organised under the premise of scarcity, access to digital resources can be conceptualised as non-rival. In the past, one physical copy of a book could only be used by one person at a given moment. As a result, the quantitative stock of a library was an indicator of the wealth and quality of the university, defined by the quality of its learning environment. In the meantime, electronic resources can be used by an unlimited number of people, since they do not hinder each other in their use. As a consequence, it is not the ownership of books, but the amount of access options to knowledge resources, or the "connectivity" of a university, which became an indicator to assess a higher education institution (Ewalt 2004).

While, in principle, non-material goods could be consumed without rivalry, some actors try to use the term "intellectual property" to gain exclusive rights on non-material products to control their use. This is an attempt to transfer the term "property", which originally stood for control over "concrete" objects, to non-material goods (ideas, information, etc.):

[18] http://www.campussource.de/
[19] http://www.blackboard.com/us/index.aspx
[20] www.webct.com

> *"In economics and marketing, a service is the non-material equivalent of a good. Service provision has been defined as an economic activity that does not result in ownership, and this is what differentiates it from providing physical goods."* (Wikipedia, 2005b)

Comparing the three types of academic knowledge resource with an open source status, economically, the tension between service and good becomes obvious. In the case of scholarly publications, the question is whether authors earn their living from salaries for their services, or from royalties from their products. Another question raised was whether the business model of commercial publishers should be based on the support of scientific communication or on the exploitation of property rights. In discussing learning materials, it became clear that higher education should be regarded as a service industry rather than as a goods producing industry. And in the case of academic software, contrasting models can be distinguished by asking whether the production and implementation of software, or the selling of licences for restricted use, should be supported.

6. Conclusions

This paper argues that with the help of ICTs, scholarly publications, course materials and academic software can be made open sources or *public goods*. This does not mean that they exclusively come as public goods, without leaving room for some private property, nor does it mean that the status as a private good is already well established for these resources. ICTs erode old certainties and make it necessary to develop new concepts and mechanisms.

The use of ICTs makes it necessary to reconsider the status of academic resources. It is important to raise awareness among scholars, academic leaders and politicians that the status as a public good is a plausible option and a serious alternative to the commodification of these resources. A sound understanding of the markets for academic resources and one's own market position is a prerequisite for making informed decisions, e.g. on issues such as purchasing publications, the assessment of sustainable business models for eLearning, or on the design and the procurement of ICT infrastructure.

What became apparent in many of the described examples is the fact that it is not enough to sympathise with the open source idea or with the status of a public good. The public domain has to be claimed, established and defended, especially in times of transition when the public/private distinction is blurred and needs redefinition. It practice, it is not enough to give away knowledge resources. It is necessary to claim and define a clear legal status with a respective business model and to provide the necessary information for the prospective users (e.g. on how to give credit to the original author, on what conditions for use, etc.). It is necessary to establish infrastructure such as reliable and interoperable repositories, publishing support services and quality control mechanisms, and it will be necessary to defend this public domain against property rights infringements and attempts to devaluate such public goods, either with short sighted profit expectations or due to financial pressures.

Given this list of tasks, it should be clear that the provision of public knowledge resources does not come for free. Where should the required funds come from? Also, in financial terms, it is crucial to address production and consumption of knowledge resources as interrelated academic responsibilities. On the basis of this concept it should become possible to gradually shift expenditure from the consumption of knowledge resources to their production.

Good news for scholars and universities lies in the fact that they do not have to start from scratch. In fact, there already exists a wide range of good examples, business models and practices in the field of academic knowledge resources. It is possible to learn from these examples and to contribute to existing networks and collective initiatives, which try to free academic knowledge from commercial restrictions. This would be the best way to share the costs of development and to improve the status of academic knowledge resources as public goods.

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