Economics of Scholarly Communication

A Discussion Paper

Prepared for

The Coalition for Innovation in Scholarly Communication

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Foreword

The Coalition for Innovation in Scholarly Communication is developing a national strategy for cost-effective access to research information. The Coalition brings together representatives from university libraries, the Academies, the Australian Vice-Chancellors' Committee, the Australian Research Council, the CSIRO, and the Department of Education, Training and Youth Affairs. All stakeholders share a common interest in securing solutions to current and anticipated problems in accessing and distributing scholarly and research information.

Scholarship and research in Australia involves a complex network of local and international relationships. The product of scholarship is edited, published, distributed, purchased and made accessible to readers. Researchers, editors, publishers, distributors, librarians and consumers of scholarly information are all involved in this cycle. The architects of public policy, government regulators and the players themselves all perform a role in determining the rules within which the cycle operates.

With the development of digital technology the channels of distribution and access and the traditional roles of the all the players in the scholarly communications enterprise are evolving. All elements of the system are under challenge, including the economic and intellectual property bases of the communication of content. The professional landscape is changing. The skills, responsibilities, executive tools and the workplaces of scholars, librarians, publishers and distributors are very different than they were only a decade ago.

This transition has brought other more subtle and potentially serious changes. The increase in output of scholarly information, its availability in new and traditional formats, the cost of introducing and supporting digital infrastructure, the increase in the price of information and the decline in real dollars to purchase these resources have contributed to a decline in journal and scholarly monograph collections in Australia’s university and major reference and research libraries. Some observers and participants speak of a 'crisis' in scholarly communication. But the situation has ramifications for all Australians, because information is a vital resource that underpins the economic performance of the nation.

This report has been prepared for the Coalition for Innovation in Scholarly Communication by Professor John Houghton of the Centre for Strategic Economics Studies, Victoria University, Melbourne, with the support of his colleagues Professor Peter Sheehan and Ms. Margarita Kumnick. It is intended to provide a summary description of the nature and extent of the current system for scholarly communication, explore its operation and open some key issues for discussion.

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Executive Summary

The underlying aim of this discussion paper is to describe and scope the present system of scholarly communication and explore the economics that govern it.

We look at:

- what is happening in scholarly communication;
- how the scholarly communication system works;
- the scope of activities within the system;
- the relationships between players in the system;
- the cost and incentive structures underpinning the creation, production and distribution of scholarly content; and
- the underlying economics of scholarly communication.

Background and context

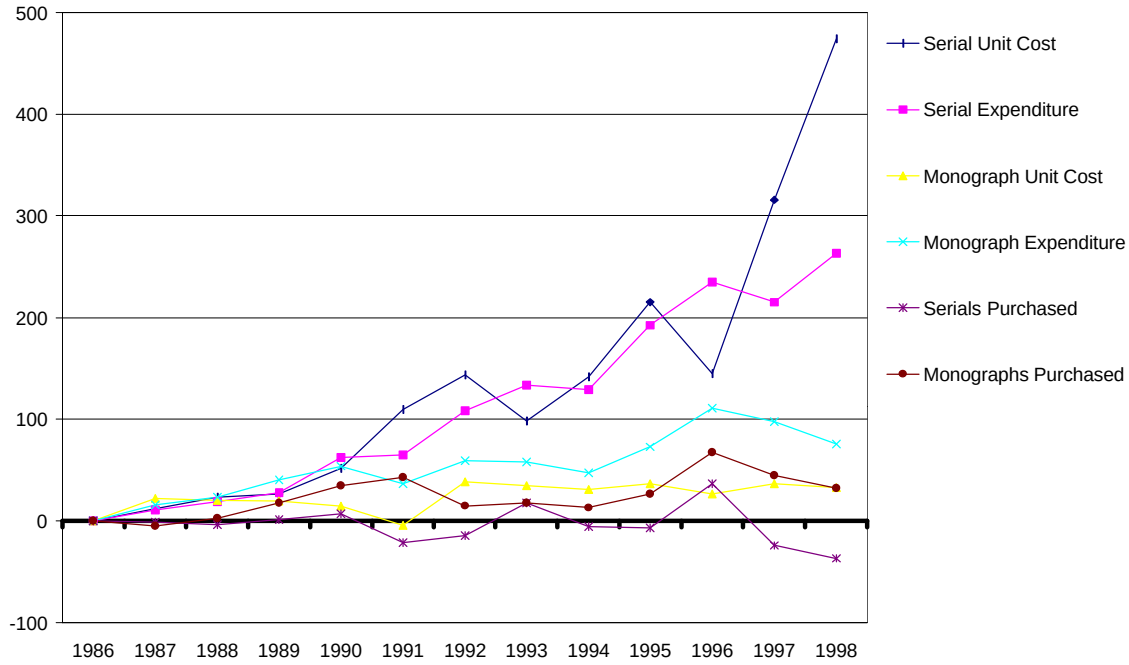
In the context of the emerging knowledge-based economy, innovation and the capacity of the national innovation system to create and disseminate the latest scientific information are becoming increasingly fundamental determinants of national prosperity. It is essential that the scholarly communication system provides cost-effective access to information in support of research and education in Australia.

But there is a 'crisis' in scholarly communication.[1] Universities and research organisations are under increasing funding pressures. There is greater focus on the efficient allocation of resources, and on achieving demonstrable return on investment in those resources. At the same time, the information technology revolution is affecting the ways in which research and education are conducted, and placing new demands on the scholarly communication system.

Recent years have seen rapid increases in the price of scholarly content – especially journals in the science, technology and medical areas. These increases are significantly above the underlying rate of inflation, and they are exacerbated by the increase in publication output and trend depreciation of the Australian dollar against currencies in which scholarly information resources must be purchased.

Between 1986 and 1998, the number of journal subscriptions in Australian university libraries declined by 37 per cent, but expenditure on them increased by 263 per cent and the unit cost of journals increased by a staggering 474 per cent.

Figure 1 Serial and monograph prices to Australian research libraries, 1986-98 (per cent change)



Notes: Preliminary data for an aggregation of libraries.
Source: CAUL (1999) *CAUL Statistics*, Council of Australian University Librarians, Canberra.

The Product Systems approach

To describe the scholarly communication system we have adopted a 'product systems' approach. It focuses on linkages between actors in a complex system that affects the transformation of activities and materials into goods and services through the processes of creation, production and distribution. This approach enables us to distinguish between, rather than confuse, the economics of each of the key stages in the process – namely, creation, production and distribution.

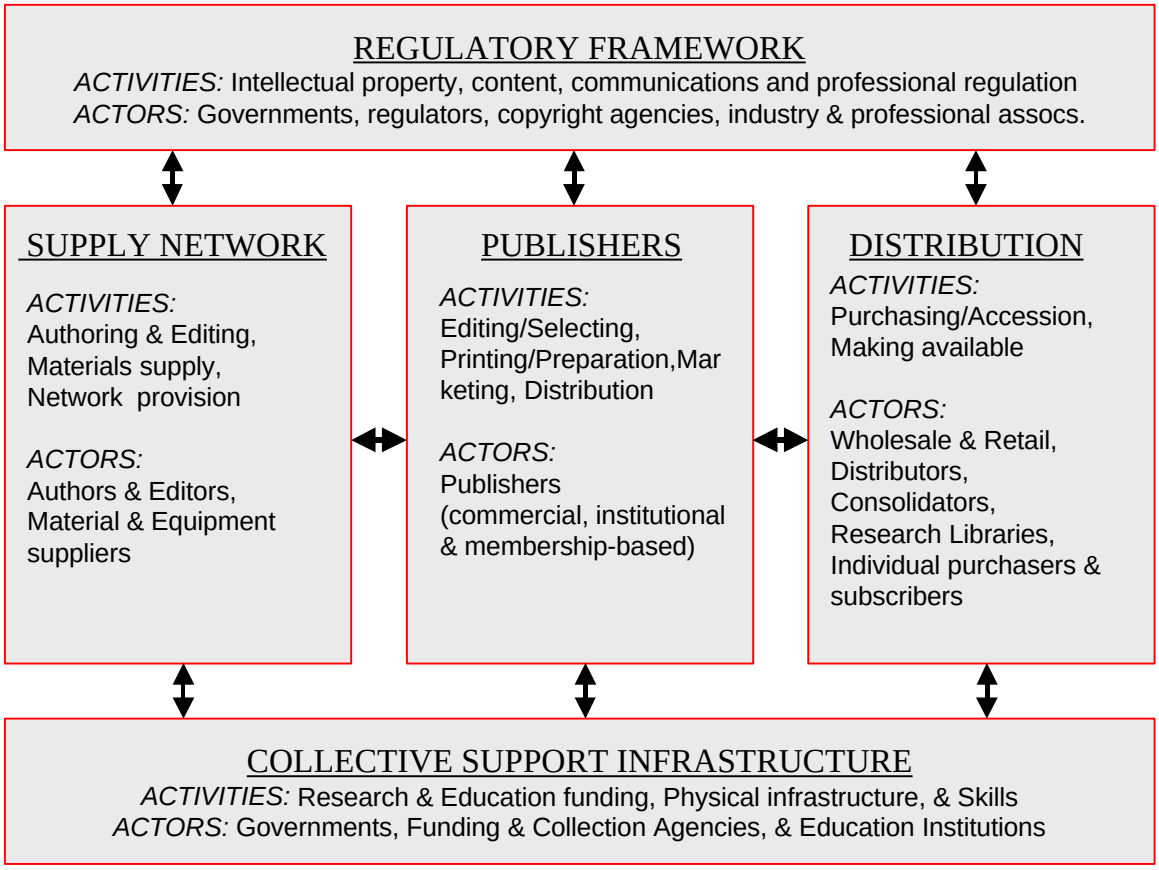
The scholarly communication product system includes five major elements.

1. At the centre are the *publishers* engaged in the production of content-based products and services. These include commercial, institutional and membership-based publishers – such as professional associations.
2. The *supply network* includes the creators of content – authors and editors, and suppliers of materials and equipment to the printing and publishing industries.
3. The *distribution network* includes all the clients of publishers, including:
   - 'the channel' – wholesalers, retailers, consolidators, aggregators, distribution and subscription agents;

- public and private research libraries, state and national libraries, and document suppliers; and
- individual institutional purchasers and subscribers.

These three groups form the core value chain of creation, production and distribution. Their activities are underpinned by a collective support infrastructure, and are subject to an overarching regulatory framework.

Figure 2 The Scholarly Communication Product System



Source: Centre for Strategic Economic Studies (CSES).

4. The *collective support infrastructure* includes:
   - the research and education funding agencies which support the research and education activities that both create and consume scholarly content;
   - various kinds of infrastructure, including:
     - research, education and library infrastructure – such as buildings and equipment,
     - information technology infrastructure – including internet, network equipment and services, and

- reproduction rights and collection agencies – such as CAL in Australia; and
- education and training infrastructure – including a range of technical and professional training institutions.

5. The *regulatory framework* for scholarly communication includes:
   - intellectual property regulation – such as copyright and licensing;
   - content regulation – such as censorship and privacy;
   - telecommunications and broadcasting regulation; and
   - professional regulation – including professional qualification standards, regulated access to practice as a professional, and professional codes of conduct.

Hence, the scholarly communication product system includes all the activities and actors (stakeholders) involved in the creation, production and distribution of scholarly content.

The Scholarly Communication Product System

Chapter 3 describes the scholarly communication product system, focusing on the core value chain of content *creation* (authoring and editing), *production* (publishing) and *distribution* (especially by research libraries). We examine each section of the product system in turn, looking at the actors and activities involved.

Our description of the *supply network* looks at:

- creators – including authors, editors, and members of editorial boards;
- the system of payments and rewards supporting their activities;
- the scope of content creation activities in Australia; and at
- specialist materials and equipment suppliers to the publishing and printing industries.

A review of education and research activities suggests that scholarly content creation involves up to 200,000 Australians, whose activities are supported by annual expenditures well in excess of $10 billion – the vast majority of which comes from government. They produce around 25,000 journal papers and perhaps as many as 5,000 book titles a year.

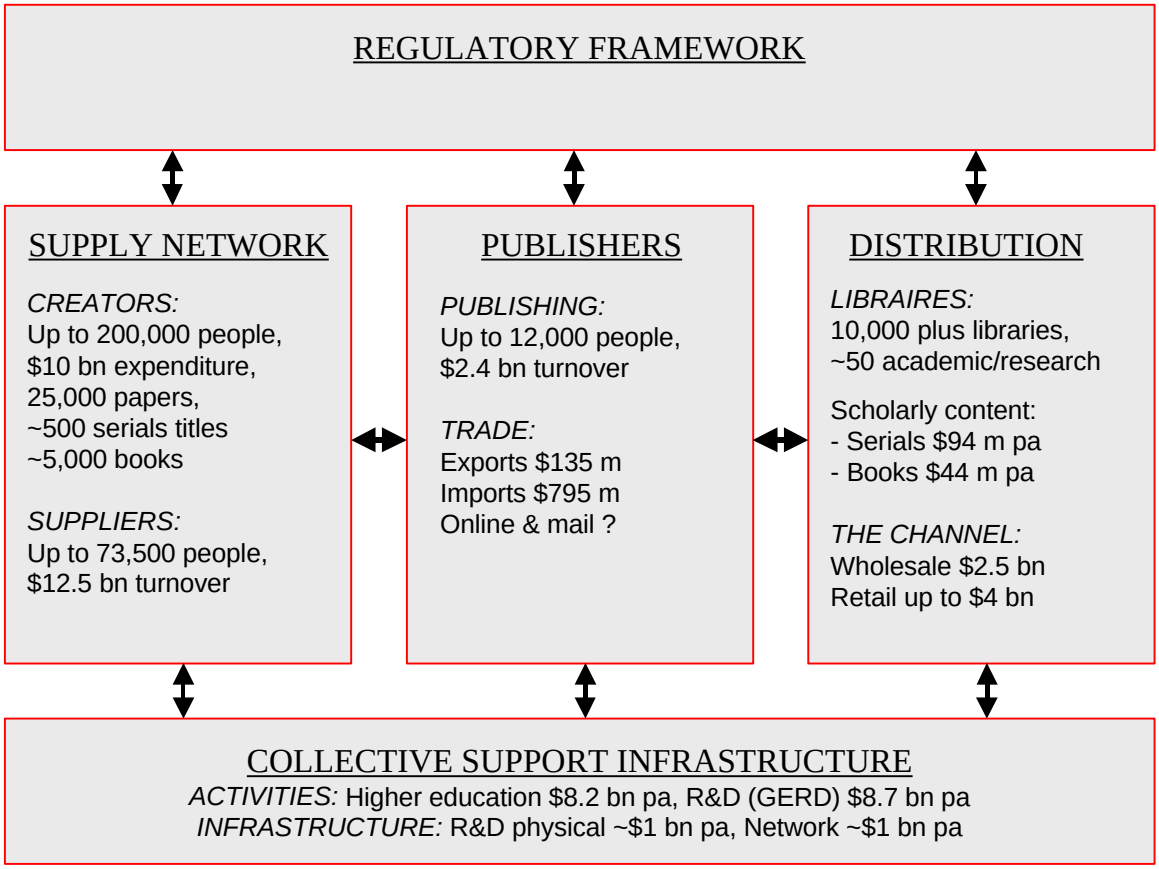
The network of specialist suppliers to the publishing and printing industries in Australia, employs a further 73,500 people and realises annual turnover in excess of $12 billion.

Our description of *publishing* activities presents a number of examples of each of the major types of publisher – commercial, institutional, and membership-based. Publishing is a global industry. There are a relatively small number of large multinational commercial publishers with significant portfolios of titles, and a very large number of smaller, niche publishers.

The publishing industries in Australia employ around 42,000 people, but most of these are in newspaper publishing. There are 6,750 people employed by periodical publishers, and a further 5,400 employed by book publishers. Combined annual periodical and book publishing turnover is around $2.4 billion.

Australia is a net importer of printed materials. During 1999, exports of publications and printed matter from Australia amounted to $135 million, while imports reached almost $795 million. Forty per cent of these imports came from the United States, 37 per cent from the United Kingdom, 11 per cent from China (including Hong Kong), and 7 per cent from Singapore. Perhaps $260 million of these imports could be considered part of the scholarly communication system.

Figure 3 Approximate scale of activities in the Scholarly Communication Product System in Australia



Source: Compiled from various sources (CSES analysis).

Our description of the *distribution network* looks at:

- libraries and library users;
- the channel – including general wholesale and retail, and specialist distribution, consolidation, subscription and document delivery services; and

- individual institutional purchaser and subscribers.

There are more than 10,000 libraries in Australia, with around 50 being university and other specialist research libraries. Australian university libraries spent $94 million on journal subscriptions in 1998, and a further $44 million on books. They pay an additional $12 to $15 million per year for copying. Specialist research centres, public and corporate research and law libraries may well have spent as much again.

Clearly, the scholarly communication product system involves a wide range of activities that are important to the Australian economy; both in terms of their sheer size – reflected in numbers of jobs, revenues realised and financial resources involved – and in terms of the importance of the scholarly communication system as an infrastructure for the emerging knowledge economy – an infrastructure which plays a key role in the communication and dissemination of ideas.

The Economics of Scholarly Communication

The second part of this discussion paper explores the main economic issues involved in the creation, production and distribution of scholarly content. Each section looks at the incentive structure, how it shapes what is happening, some of the issues involved, and some of the economic arguments that are discussed in the literature.

Looking more generally at the economics of knowledge and information, we suggest that the commonly used distinction between tacit and codified knowledge, highlights an important economic characteristic. Namely, that while knowledge is a pure 'public good', information is not.[2] Hence, as information products, scholarly books and journals cannot be treated as public goods.

Nevertheless, information is, basically, non-rivalrous in consumption. If one person consumes a cheese sandwich, it is gone. No one else can consume it. If, however, one person reads a journal article and gains knowledge from it, the information in the article remains. Any number of people can consume it again.

This 'scarcity defying expansiveness of knowledge' is one of its most important defining features. It means that ideas and information exhibit very different characteristics from the goods and services of the industrial economy. The social value of ideas and information increases to the degree they can be shared with, and used by others. The more such items are produced, the greater the social return on investment in them. So social returns are maximised through expansion of access and wide dissemination, not by limiting access and exclusion.

It is important to understand what the product is, and where the value lies in the scholarly communication system. Many assume that the product is content. In one sense, of course, it is. But that is not the whole story. Information is an 'experience good'. Until you have bought and consumed the information you do not know its value, and once you have it is too late to decide not to buy it. So the decision to buy is not made on the basis of the content, directly, but on the basis of other cues.

For example, a researcher new to a field might make extensive use of abstracting and key word searching to identify articles to read. More experienced researchers might use other signals, such as:

- who the authors are,
- the institutional affiliation of the authors,
- knowing the work of the editor and editorial board members,
- the title of the journal, or
- the brand – the publisher and publishing stable.

Because the decision to consume is made in these ways, these things become important sources of value. Content may be king, but authorship, quality control and branding are major determinants of value.

Economics of content creation

There are important, and in some ways highly negative, institutional incentives underpinning the creation of scholarly content. Promotion, tenure, and funding allocations in universities and research institutions are often linked to publication in a few, key, refereed journals. This structure of institutional incentives appears to be creating a widening gap between publication, on the one hand; and scholarly communication and dissemination, on the other. With declining circulation, print publishing is not serving the need for dissemination and communication as well as it might.

Looking at some of the alternative models for scholarly communication suggested in the literature, and at some of the issues involved in those alternatives, we suggest that:

- payments *by* authors to publishers have a number of negative implications for scholarship (eg. publication according to means, rather than merit) and face high transactions costs;
- payments *to* authors face similarly high transaction costs, and simply raise production costs and thereby prices;
- self publishing may not reduce costs as much as expected, may not meet the need for wide dissemination, and may undermine some of the value in the present system – in, for example, selection, quality control, branding, and cuing; and
- the success of pre-print servers is likely to be greater in the natural sciences, where there is less selecting out, than in the humanities; and in theoretical discourses rather than applied discourses.

Aligning the interests of publication and dissemination by creating a positive set of institutional incentives, through changing the performance criteria commonly used in universities and research institutes, is an essential reform.

The economics of production

Looking at the economics of production or publication, we focus on the incentives facing publishers, production costs and various publishing business models. We also explore the issues of competition and concentration in the scholarly publishing industry.

One of the differences between a resource-based and a knowledge-based economy is that producers are more likely to face increasing, than decreasing returns. In the absence of other intervening forces, increasing returns result in concentration – fewer, larger firms. So it is not surprising that there are a few, large commercial publishers, or that they are growing – both organically and through mergers and acquisitions. Indeed it would be surprising if it were otherwise.

The key question is: are these potential 'monopolies' sustainable? If they are, then it is possible that monopoly power will be exercised in the market place. If not, monopoly power is less likely to be a longer term problem.

John Kay, Director of the London School of Economics, suggests that the fear of concentration and the development of winner-takes-all markets in the knowledge economy is exaggerated. Kay contends that the expansion of the knowledge economy will create a proliferation of materials, firms and activities at all points and at all levels – suggesting that no one can expect to enjoy continued control of these markets. Kay suggests that it is misconceived to think that the key lies in being at the point of delivery of the product, the low cost and ease of access to the delivery mechanism (the internet) mean that the rents are driven down at the delivery level, and instead migrate back up the value chain to those with genuinely scarce factors and competitive advantages.[3]

If these 'genuinely scarce factors and advantages' rest with the content creators (authors), then electronic publishing promises to deliver scholarly communication from the hands of commercial publishers into those of the creators. If, on the other hand, they rest with brand holders, who turn the quality control and selection processes into key dimension of value in their products, then electronic publishing may not revolutionise the structure of the scholarly publishing industry as much as most people seem to expect. But, if Kay is right, commercial publishers can expect competition from a wider range of players in the scholarly communication system than is currently the case, and from new emerging players that are not yet a part of the system.

The key features of publishing costs in the print environment are:

- high first copy costs, low marginal costs;
- high article processing costs – approximately 45 per cent of total production costs;
- high marketing and administration costs – approximately 28 per cent of total; and
- low physical distribution costs.

Significant cost savings could be made by streamlining or obliterating journal article processing activities, but because distribution costs are a relatively small part of total costs electronic distribution (of itself) is unlikely to lead to major publisher cost savings.

By implication, then, unless the whole process is geared to purely electronic publication cost savings may be relatively modest, dual mode publication (print *and* electronic) simply increases costs. Moreover, there are significant infrastructure and transitional costs involved in shifting from a print to an online environment.

The economics of distribution

In the section on the economics of distribution we look at library distribution costs and how common library purchasing practices in the print environment have interacted with, and reinforced, publisher business models.

There are a number of important things to note about the print purchasing practices of research libraries over recent years. Namely:

- journal titles and books compete with each other *as substitutes* across broad fields, rather than being considered separately;
- the budget for purchasing in each field is determined by the strategic priorities of the institution, such that titles across fields do not compete on cost per use;
- the budget for each field has been determined largely independently of price information, and largely independently of demand or usage information;
- the budget allocations to each field have taken little or no account of price per use across fields; and
- price signals have rarely reached end users.

These features of the print publication acquisition system add up to two related things. First, an almost complete failure of market signals – especially of price signals to the end users. Second, very low price elasticity of demand – with large price changes having relatively little effect on demand.

In general, wherever one sees low price elasticity of demand, one sees high prices; and wherever one sees high price elasticity of demand, one sees low prices. So improving the transmission of price signals to the consumer should be a priority for anyone who wants to see lower prices.

Indeed it is notable that in the projects and trials where price signals are transmitted to end users in an online delivery system, such as OhioLink and PEAK, reported and implied price elasticities of demand appear to be much higher than in the traditional library–print system.

A vicious circle

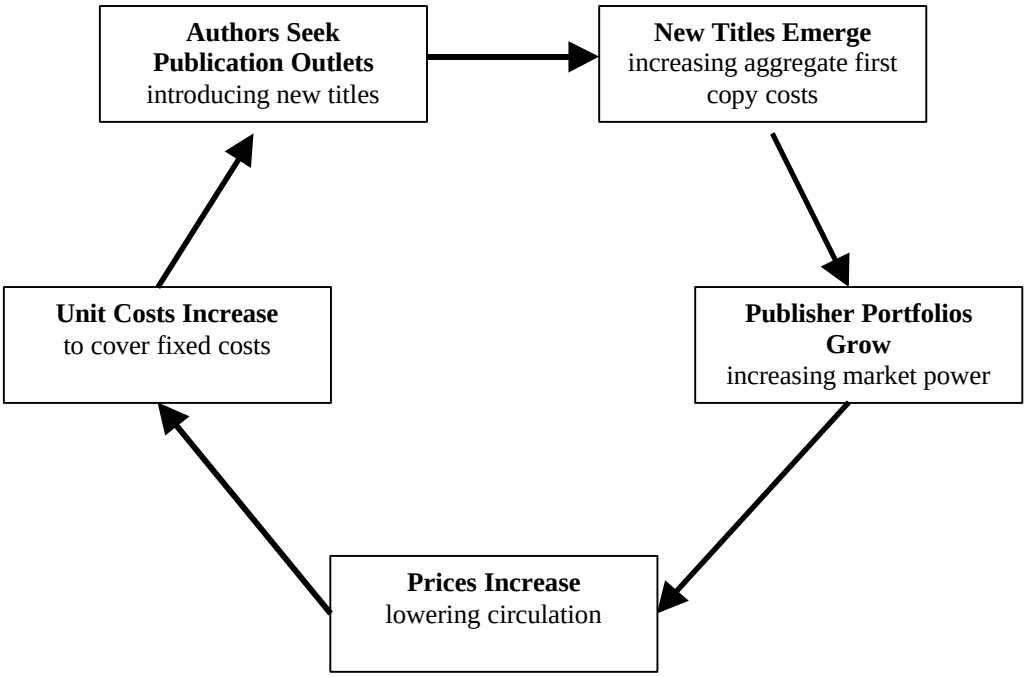
There has been a feedback loop operating in the print-based scholarly publication system in which:

- authors seek new publication outlets, introducing new titles;
- new titles emerge, increasing aggregate first copy costs;

- publisher portfolios grow;
- prices increase, lowering circulation;
- unit costs increase, to cover fixed costs; and
- so it goes on.

The challenge is to find points of leverage at which this vicious circle can be broken.

Figure 4 A feedback loop of escalating prices for scholarly content



Source: Centre for Strategic Economic Studies (CSES).

The Way Ahead

This discussion paper is intended to be a first step; raising issues and suggesting future study options. It is impossible in a short paper to reflect the complexity of the issues. There is no obvious solution, no single solution, and no easy solution to the difficulties currently faced by those seeking the cost-effective dissemination of scholarly information. Nevertheless, at the level of general principle one can see broad avenues for action.

If the problem can simply be stated as stemming from high prices, then:

- if, on the one hand, we believe that prices reflect the costs of production, then we must reduce costs in order to reduce prices;

- if, on the other hand, we believe that prices reflect what the market will bear, then we must either ensure that what the market will bear reflects value in use, or reduce what the market will bear, in order to reduce prices.

Market conforming approaches

Market conforming approaches involve pursuing avenues which improve the transmission of market signals throughout the scholarly communication product system, creating a coherent and effective structure of incentives throughout the system, and increasing competition in scholarly publication.

Improving the transmission of market signals might be achieved by such means as:

- increasing the price elasticity of demand by sending price signals and devolving choice to the end consumer;
- increasing competition between titles by introducing greater flexibility in budget allocations; and
- increasing product divisibility by using mixed subscription and on request pricing models.

Creating an effective structure of incentives throughout the scholarly communication product system is essential. By tying promotion, pay, tenure, research funding and other basic rewards to publication in a few, key, refereed journals in each field, universities and research institutions have created a dysfunctional system of incentives. Reform is required to the institutional incentives facing authors, in order to align the goals of publication and dissemination, and the interests of authors and readers.

Encouraging competition in the scholarly communication industry might involve a variety of things aimed at developing new mechanisms for communication, publication and dissemination, and encouraging new entrants to join the scholarly publishing industry. These might include:

- exploring a wider range of electronic communication, dissemination and publishing options;
- starting new published journals or collections;
- developing alternative win:win business models for publishers and their clients;
- exploring more radical bundling and/or price discrimination models;
- encouraging the entry of new players; and
- extending the use of pre-print server style publication, in combination with exploring ways to overcome the quality control and authenticity issues.

Market distorting approaches

Market distorting approaches include consortial purchasing and national site licensing, which operate by confronting producer (publisher) power in the marketplace with increased purchaser power – fighting monopoly with monopsony.

A national site license approach, such as that adopted in Canada, implies government intervention and financial support. Consortial purchasing simply recognises the common needs, and funding sources, of Australia's research libraries, and provides the opportunity for them to exercise their collective purchasing power in the market place.

Both provide avenues for addressing the 'crisis', or at least turning the tide, and buying time during which the transition from the print-based to an entirely electronic system can be worked through.

Future Study Options

Publication has been the main mechanism for scholarly communication and dissemination, but it may not be in the future. Indeed, it may not be now. Odlyzko has recently pointed out that scholarly *communication* is changing rapidly, but scholarly *publication* is not keeping up.[4] The widening gap between scholarly communication, on the one hand, and publication, on the other, seems to be at the crux of the issue.

The practice of research

One key question for future study is: *how is the practice of research changing?*

There are a number of inter-related dimensions of change:

- information and communication technologies are revolutionising scholarly communication and dissemination – not only is IT an indispensable tool for analysis in many areas (eg. the human genome), it is also providing new opportunities for low cost, almost instant communication of documents, and easy international collaboration;
- pressures on research funding, and pressures for the commercialisation of research are increasing – resulting in very different needs for communication and dissemination with the underlying tension between the scientific demand for publication and dissemination and the commercial need for confidentiality;
- these pressures are also leading to a bifurcation – with some remaining in the traditional academic world of time-rich, cash-poor research, and others moving into the increasingly commercialised world of *relatively* cash-rich, time-poor research and demanding very different information access;
- research and education are becoming less institutionalised – being practiced in a much wider range of organisational and institutional settings than before; and
- commercial applications of science are becoming increasingly multi-technology and multi-disciplinary.

The key question is: how are these changes affecting the ways in which researchers communicate and access information?

Studies now emerging on how researchers use online access to papers and how different it seems to be from how they used, or were thought to use, print, are very interesting and important, but they tend to take a supply-side perspective. The really interesting study would be from the demand-side: looking at the practice of research, how it is changing, and what that implies for access to, and demand for, information both now and into the future.

Such a study might take a very broad view, looking at the ways in which science is practiced in various institutional settings and disciplines. It would begin from studies in the history and philosophy of science and innovation, and try to draw out the implications of a range of fundamental changes in the practice of science for the scholarly communication systems.

Pricing models

In developing pricing strategies for the emerging online publication paradigm there are opportunities to learn from other industries that have experienced, or are experiencing similar transformations.

There has, for example, been an enormous amount of work gone into developing pricing models in telecommunications, with deregulation and the introduction of competition, digitalisation of the communications network and the introduction of rate-based regulation – involving price-capping and graduated rate re-balancing. Rate-rebalancing in telecommunications is about managing the transition from monopoly supply, with many inherent cross-subsidies and relatively little information about actual costs, to competition, with the need to bring prices into line with attributable costs, in an environment that is essentially network-based, during a period of rapid technological change, with digitalisation of formerly analogue networks, and the implied need for significant network infrastructure investment. During this transition a key issue has been how to manage the balance between fixed charges and usage charges in such a way as to achieve sufficient revenue from fixed (access or subscription) charges to provide for ongoing infrastructure investment, while at the same time ensuring that usage charges are set with reference to the directly attributable incremental costs of that usage.

While there are clearly differences between telecommunications and online publishing businesses, there are also strong parallels. The implications of various mixes of fixed (subscription) and usage charges in such industries as telecommunication, how pricing models have evolved, and the issues confronted during that evolution might usefully be reviewed and mined for potential lessons for the development of online publishing and distribution pricing and business models.

The economics of online scholarly communication

The economic implications of the special characteristics of information have been explored in the general economic literature and are reasonably well known, but their implications for the emergence of new industrial structures and new business models are only now beginning to be worked through. Nevertheless, there is an increasing number of explorations of the nature and operation of emerging online information businesses.

These could be explored in order to develop possible alternative models for the online publication and distribution of scholarly content – approaches which take into account both the unique economic characteristics of scholarly content and the emerging economics of online businesses, and take the form of detailed studies of the economics of alternate online electronic systems.

Institutional incentives

By tying promotion, pay, tenure, research funding, and other basic rewards to publication in a few, key, refereed journals in each field, universities and research institutions have created a dysfunctional system of incentives. The print journal publishing system has evolved into a mechanism for the development of CVs, rather than one for the communication and dissemination of ideas. An important area for future work is to address this problem.

One approach might be to undertake an analysis to develop, and through consultation refine, a set of performance indicators that would be acceptable to universities and research institutions *and* be in line with the goals of cost-effective dissemination without generating the dysfunctional consequences that plague those currently used. These could be trialed, and old system–new system indicators compared to ensure that key performance measures are both meaningful and effective.

Obviously, there are already significant changes underway in research performance measurement, especially in shifting the focus towards output-based indicators.[5] Nevertheless, there is a need to move further and faster in reforming incentives, and a need to take a more holistic, systems perspective on performance indicators and incentives than has been the case to date.

Scholarly communication system statistics

A recurring theme during research for this discussion paper has been the lack of sometimes quite basic data. Many have commented on the irony of the situation – of an information industry with very little information about itself.

Libraries: The library community does not have a particularly good handle on its own costs, or standard approaches to data collection on holdings, expenditures, staffing, etc. All too often judgements are made, rather than decisions, because of a lack of information. Benchmarking library and related functions is still difficult, and so little is

known about the real value of assets that decisions about how much it is worth spending on their upkeep and preservation are imprecise at best.

Moreover, the lack of holistic costing has the potential to distort the market signals and create incentives with potentially negative effects. For example, what is included in university library budgets varies from institution to institution, but it is becoming increasingly common for a significant proportion of IT costs to be sheeted home to the library while building infrastructure costs are not. This could lead to a preference for the maintenance of the print paradigm (print, shelves and buildings) over the electronic paradigm, even though the former's total costs may be higher.

Publishing: Despite the fact that the publishing industry is a major, global industry operating in the 'new economy' surprisingly little industry data are collected. Financial information is less extensive than in many other industries, because a relatively high proportion of publishing companies are private, rather than publicly listed. Many publishers and book sellers are interested in sales revenue and units sold (books), while others in the scholarly communication product system are more interested in titles produced. This has led to the collection of a mixture of cross-cutting and sometimes overlapping data, rather than to the collection of a coherent set of data which provide a complete picture of the industry.

There is, in short, a clear need for better statistics throughout the system; and given the increasing importance of the scholarly communication system in the emerging knowledge economy, it is becoming increasingly important that this need be addressed. Notwithstanding a number of international statistical initiatives,[6] there is scope for Australia to contribute to the development of both institutional and industry data definitions and collections.

Scholarly communication in transition

The scholarly communication system is in the relatively early stages of a transition from print publishing to online communication and dissemination. A transition as fundamental as that facing any industry as we move into the knowledge economy era and go online. This transition comes on top of a 'crisis' in prices.

While in the long run online communication, publication and dissemination may provide the basis for a solution to the 'crisis', in the short term it is simply exacerbating it. Players throughout the scholarly communication product system, especially in publishing and distribution, must develop new skills and organisational competencies suitable for the online environment, implement new procedures and practices, develop new business models and build and/or call into being an online scholarly communication infrastructure; while at the same time maintaining the existing print paradigm.

Australia is relatively well advanced in terms of adopting the online publishing and distribution paradigm, with some institutions going entirely electronic and abandoning their print journal collections. Other institutions are slower to change, and they face

additional hardship because they are trying to operate a dual mode (print and online) system, with all the additional overhead costs that that implies.

It is important to realise that despite the enormous promise of digitalisation, there are significant transitional costs involved in moving from the print to the online paradigm: costs that Australia's universities, research institutes and research libraries are finding extremely difficult to bear. Case studies of organisational change, analysing the transition from print to online access would shed light on transitional issues and provide invaluable information for Australian universities and research institutions facing the transition.

The 'Crisis'

The 'crisis' in scholarly publishing and the challenge of electronic publishing are typical of technological change. The first reaction to technological opportunity is almost always to automate what one is currently doing. But it is rarely the real answer.

The pay-off from new technological opportunities typically comes when one uses the technology to do things differently and/or to do new things. It is unlikely that simply publishing journals electronically is the answer. The challenge is to work out what to do differently and what new things to do, to facilitate the cost-effective communication and dissemination of ideas.

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1 Background

In the context of the emerging knowledge-based economy, innovation and the capacity of the national innovation system to create and disseminate the latest scientific information are becoming increasingly fundamental determinants of national prosperity. Indeed, it has been observed that prosperity in a knowledge economy depends as much, if not more, upon the knowledge distribution power of the system than upon its knowledge production power.[7] This makes the scholarly communication system an increasingly important element of the national innovation system. It is essential that the scholarly communication system provides cost-effective access to information in support of education, research and industry in Australia.

But there is a 'crisis' in scholarly communication.[8] Universities and research organisations are under increasing funding pressures. There is greater focus on the efficient allocation of resources, and on achieving demonstrable returns on investment in those resources. At the same time, the information and communications technology revolution is affecting the ways in which education and research are conducted and placing new demands on the scholarly communication system, with new ways to access and deliver information. Moreover, recent years have seen persistent and marked increases in the price of scholarly content – especially of journals in the science, technology and medical areas, and more recently in management. Indeed, science and technology journals have increased in price by approximately 10 per cent per annum for at least the last decade.[9] These price increases are significantly above the underlying rate of inflation, and they are exacerbated by an increase in publication output and a trend depreciation of the Australian dollar against currencies in which scholarly information resources must be purchased from publishers.

Without fundamental change in the scholarly communication system Australia's position in the developed world may be at risk. Access to scholarly content through research libraries is already being compromised. Over the medium term this can only have a negative impact on the standard of education and research in Australia. Over the longer term it may threaten our ability to participate in the global knowledge economy, and thereby undermine opportunities to enhance prosperity in the 21st century.

The purpose of this discussion paper is to describe and scope the present system for the creation, production and distribution of scholarly information, and to explore the economics that govern the system in order to further our understanding of the nature of the current 'crisis' and of the challenge we face.

1.1 The context

The 'crisis' in scholarly communication has arisen in the context of rapid and significant changes. The transition from a resource-based to a knowledge-based economy has

brought changes in the economics that underpin the operation of the economy. The information technology revolution has brought fundamental change to the nature and conduct of research and education, the capacity for scholarly communication and the cost structures underlying the scholarly communication 'industry'.

1.1.1 Economics in the Knowledge Economy

The knowledge economy has been defined as:

> "…one in which the generation and exploitation of knowledge has come to play the predominant part in the creation of wealth. It is not simply about pushing back the frontiers of knowledge; it is also about the more effective use and exploitation of all types of knowledge in all manner of economic activities."[10]

Knowledge is fundamentally different from the physical resources that have underpinned the economy in the industrial era and provided the basis for traditional economic analysis, and these differences have implications for the way a knowledge economy is organised. It is likely that information content industries will be structured differently, information content businesses will operate differently, and the information or knowledge economy will function differently.

The economic implications of the special characteristics of information products and services have been explored in the general economic literature and are reasonably well known, but their implications for the emergence of new industrial structures and new business models are only now beginning to be worked through. Among the more important of these implications are:

- The potential for increasing returns to lead to concentration and monopoly power in the market place;
- The tendency for online products to behave differently, be priced differently and be valued differently to their offline (print) equivalents, because putting them online makes them more nearly perfectly non-rivalrous;
- The tendency for high up-front and low or zero marginal costs of production to lead firms to abandon marginal cost pricing and live off rents derived from prices substantially and sustainably above marginal cost;
- Perversely, high up-front and low marginal costs mean that the more competing products there are in the market the higher are aggregate fixed costs, such that the entry of competing products and firms will tend to increase prices (*if* prices reflect costs);
- Because of non-additivity investment is no longer directly related to output;
- Because knowledge products are taken more directly to consumers, the demand side takes on greater importance in shaping the development of information products and the technology behind them; and

- There is greater opportunity for disintermediation in the value chain.

Box 1.1 Economic characteristics of knowledge

Non-rivalrous in consumption – the consumption of information by one party does not prevent others from consuming it, so that value in consumption can be enjoyed again and again. Knowledge exhibits scarcity-defying expansiveness, or infinite expansibility.[11]

Increasing returns / Low (zero) marginal cost of production – with physical goods the more one produces the more likely it is that one will eventually encounter scarcities that drive up production costs and reduce the size of social returns. In contrast, while the up front development costs of information products can be very high, the reproduction and transmission costs are low; such that the more information items are (re)produced the greater the social return on investment. Information businesses typically enjoy increasing returns, and increasing returns tend to lead to concentration in the market. Some suggest that the knowledge economy will tend to be a winner-takes-all economy.[12]

Knowledge exhibits public good characteristics – a public good is one which is non-rivalrous in consumption and from which others cannot easily be excluded. In the market place excludability is instituted in the form of intellectual property rights which aim to turn the public good into something more like a private good.

Information (knowledge) is inherently subject to spillovers – there are, typically, wider implications and applications than that which the creator intends. Hence, the producer will not reap the full benefits of investment, and beneficiaries of the unintended applications do not contribute to the cost of production. One consequence of this is that in a free market there will be systematic underinvestment in knowledge.

Information (knowledge) products often exhibit network externalities – the value to a user depends upon how many other users there are, as well as the inherent value of the product or service. For example, it makes sense for me to use Microsoft Office® and Windows® because of the widespread support, ease of file transfer and exchange, etc. that result from its widespread adoption as a desktop standard – quite aside from their inherent qualities.

Knowledge products exhibit inherent unknowability – knowledge goods have some of the characteristics of experience goods: unless one has used them before one does not know how useful they are, and the value of information cannot be known until it has been consumed.

Non-additivity – production of knowledge-based products is not necessarily scalable. For example, putting five scientists on the task would not necessarily have led to the theory of relativity in 20 per cent of the time it took Einstein.

Source: CSES.

In business and policy thinking, the often implicit and sometimes rather simplistic adoption of the concepts and language of traditional neo-classical economics does not yet take sufficient account of the variations to the 'standard' assumptions required to accommodate information-based products and services. Consequently, many are struggling to develop new business models for the knowledge economy.

1.1.2 The online revolution

The information technology revolution has brought fundamental changes to the operation of the economy, the structure of many industries, the strategy of many businesses and the operation of the scholarly communications industry. These changes affect the very nature of education and research, as well as the dissemination of information among the global scientific community and its transfer and diffusion through the economy.

Box 1.2 Why codified knowledge matters

Many of the major benefits of a science system occur through tacit transfers of knowledge and skill transfers rather than through codified knowledge, such as patents or scientific papers. Nevertheless, codified knowledge in the form of published scientific literature remains important. It:

- provides valuable knowledge to institutions or firms with enough scientific capacity to absorb it;
- is accessible to many users and can be disseminated easily and cheaply;
- provides a permanent store of knowledge that can be exploited years after its production;
- provides pointers to key research and to important practitioners of science – whether they are institutions or individual researchers; and
- certifies the origin of ideas, which is important in determining status and promotion within the institutions producing research outputs.

Source: BIE (1996) *Australian Science: A Snapshot of Australia's Performance,* AGPS, Canberra, p2.

Low cost and readily accessible global communication has put scholars in touch with their colleagues around the world and enhanced their ability to follow, and participate in, world leading research. It has put educators and classrooms in touch with each other, and with a world of ideas previously unavailable to them. Crucially, it has the capacity to transform researchers, educators and students from being passive consumers of, to being active participants in, scholarly communication.

Electronic delivery of information in the education and research enterprises is set to greatly expand the availability of that information, and emerging value adding

technologies (hypertext, search engines, etc.) are increasing the value of that information in use. That same electronic delivery is radically altering the cost structures of all stages of the scholarly communication product system – including creation, production and distribution – and it is set to transform the industrial and institutional structures that underpin scholarly communication.

1.1.3 Clients and market pressures

The increasing economic importance of education and research in the knowledge economy era is occurring at the same time as increasing fiscal constraint on government budgets. Researchers and educators, individual and institutional, are being forced into increasingly commercial, market oriented activities. There are greater demands being made, real funding constraints, new choices to be confronted about directions for development, and much greater demand for accountability. Everyone involved in the scholarly communication 'industry' must now be accountable for costs, and be able to demonstrate a return on investment in order to 'survive the cut'.

These pressures are leading to profound structural change in the scholarly communication system. There is little doubt that in some areas of endeavour we are structurally and institutional incapable of meeting the mulitdimensional challenges we face without fundamental change. Becoming more market oriented and more market driven is likely to continue to be one of the major dimensions of that change, and turning back the clock to an idealised collegial world where knowledge is pursued for its own sake is unlikely to be a realisable dream. The 'crisis' in scholarly communication is an economic crisis, but if we fail to find a resolution will it become a crisis of scholarship.

1.2 The 'Crisis'

Recent years have seen persistent and marked increases in the price of scholarly journals; especially in the science, technology and medical areas (STM), and more recently in management.

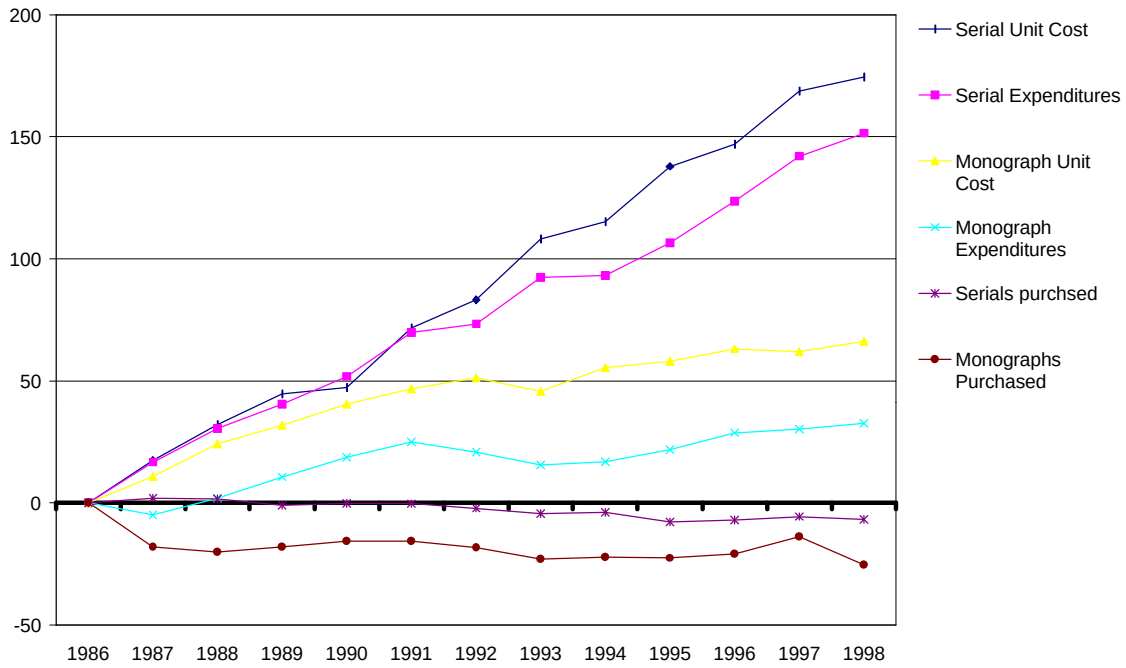
Association of Research Library (ARL) statistics from United States research library purchasing between 1986 and 1998 show that median monograph unit costs increased from $US 28.65 in 1986 to $US 47.59, or by 66 per cent, while median serial unit costs increased from $US 88.81 in 1986 to $US 243.85, or by 175 per cent in current prices. Over that period, median unit prices paid for monographs went up at an annual average 4.3 per cent and median monograph expenditures 2.4 per cent, while median unit prices paid for serials went up at an annual average 8.8 per cent and median serial expenditures at 8 per cent. The median number of serials titles purchased declined by an annual average of just 0.6 per cent, while median monograph title purchases declined at an annual average 2.4 per cent.[13]

Table 1.1 Serial and monograph prices to US research libraries, 1986-98 (median values)

Year	*Serial Unit Cost $US*	*Serial Expenditures $US*	*Monograph Unit Cost $US*	*Monograph Expenditures $US*	*Serials Purchased No*	*Monographs Purchased No*
Libraries	*40*	*103*	*62*	*99*	*40*	*62*
1986	88.81	1,517,724	28.65	1,120,645	16,198	33,210
1987	104.30	1,770,567	31.76	1,064,484	16,518	27,214
1988	117.25	1,979,604	35.63	1,141,226	16,443	26,541
1989	128.47	2,130,162	37.74	1,241,133	16,015	27,268
1990	130.81	2,304,744	40.26	1,330,747	16,182	27,999
1991	152.43	2,578,309	42.04	1,400,738	16,149	28,027
1992	162.72	2,630,827	43.31	1,353,865	15,846	27,158
1993	184.71	2,919,756	41.78	1,295,807	15,463	25,583
1994	191.13	2,932,091	44.51	1,309,807	15,583	25,803
1995	211.29	3,133,885	45.27	1,365,575	14,942	25,719
1996	219.46	3,393,307	46.73	1,444,015	15,069	26,262
1997	238.69	3,674,368	46.42	1,460,234	15,297	28,658
1998	243.85	3,818,832	47.59	1,486,764	15,100	24,761

Source: ARL http://www.arl.org

Figure 1.1 Serial and monograph prices to US research libraries, 1986-98 – median values (per cent change)



Source: ARL http://www.arl.org

There are significant prices difference by field for both books and journals. Looking at book prices in the United States between 1970 and 1992, science and technology book prices appear to have risen faster than others. Prices for books in the arts and humanities more or less tracked inflation during the 1970s and 80s, but during the 1980s prices for books in science and technology increased at an annual average rate approaching 9 per cent. Prices for books in medicine have taken off more recently. These fields are also the ones with the most expensive books, so it is the more expensive books that are rising most rapidly in price.[14]

Looking at titles published in the United States and Canada, Bosch has tracked the prices of academic books between 1989 and 1997. He has found that average book prices have increased from $US 41.69 in 1989 to $US 52.68 in 1997, or by 26.4 per cent. The largest average book price rise over the period occurred in military and naval science (81 per cent), with increases well above the average in philosophy and religion, and chemistry (44 per cent), physics and astronomy (43 per cent), political science and sociology (41 per cent), and agriculture (38 per cent).[15] These data suggest that after rapid rises in STM book prices, book price increases are now spreading into humanities subjects.

Cummings et al. report that data from the *Library Journal* suggests that scientific and technical journal prices in the United States increased more than eleven fold between 1970 and 1990. The relative price differential between serials in, for example, chemistry-physics and in literature-languages has steadily expanded: the ratio was 3.5 in 1963 (that is, the average serial in chemistry-physics was 3.5 times more expensive than the average serial in literature-languages), 5.4 in 1970, 9.2 in 1982, and 13.5 in 1990.[16]

Australian research library expenditures show a very similar overall pattern of price changes. Serial unit costs to libraries have increased more rapidly than monograph unit costs, serials expenditure has increased more rapidly than monograph expenditure, and the number of serials titles purchased is declining more rapidly than monograph titles purchased. Between 1986 and 1998 the median unit price of serials titles purchased by Australian research libraries increased from $158.49 to $358.35 or by 126 per cent, while median monograph unit prices increased from $48.44 to $62.34 or by 52 per cent (current prices). Over the same period there was an 18 per cent decline in the median number of monograph titles purchased, and a 24 per cent decline in median serials subscriptions; and yet median monograph expenditures have increased 25 per cent, while median serials expenditures have increased 71 per cent.

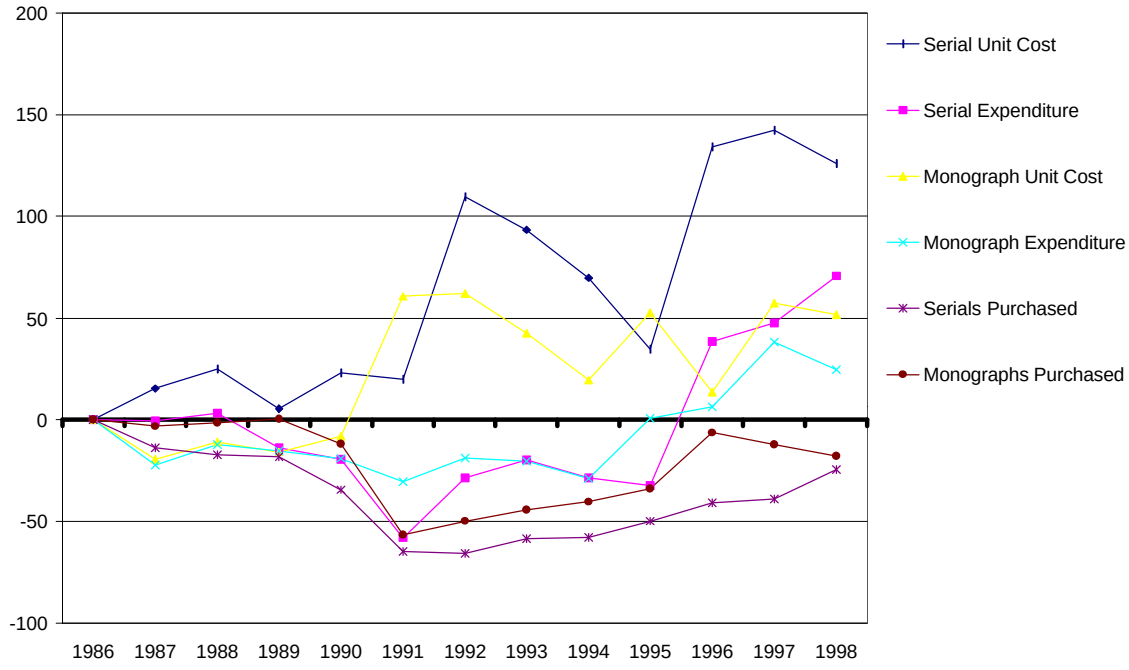
Figures 1.1 and 1.2 show the same data for American and Australian research libraries, respectively. There is more volatility in the Australian graph, but the overall similarity of the pattern is striking. Across the sample of Australian research libraries, the total number of serials purchased declined by almost 37 per cent between 1986 and 1998, but total serials expenditures increased by 263 per cent, and aggregate serial unit costs by no less than 474 per cent.

Table 1.2 Serial and monograph prices to Australian research libraries, 1986-98 (median values)

Year	*Serial Unit Cost $*	*Serial Expenditure $*	*Monograph Unit Cost $*	*Monograph Expenditure $*	*Serials Purchased No*	*Monographs Purchased No*
Libraries	*55*	*55*	*58*	*58*	*55*	*61*
1986	158.49	1,062,146	48.44	767,469	6,702	18,693
1987	182.86	1,056,214	42.82	597,881	5,776	18,094
1988	197.90	1,097,935	47.65	672,211	5,548	18,411
1989	167.06	916,164	44.00	649,188	5,484	18,773
1990	195.21	857,054	46.74	621,160	4,391	16,443
1991	189.97	446,228	65.99	533,741	2,349	8,088
1992	332.08	760,471	66.56	623,649	2,290	9,370
1993	306.45	852,548	58.50	609,525	2,782	10,419
1994	269.05	759,272	49.02	545,659	2,822	11,131
1995	213.56	718,208	62.66	772,477	3,363	12,329
1996	371.34	1,471,242	46.61	814,917	3,962	17,485
1997	384.01	1,567,356	64.59	1,060,263	4,082	16,416
1998	358.35	1,813,618	62.34	957,200	5,061	15,354

Note: Preliminary Data.
Source: CAUL (1999) *CAUL Statistics*, Council of Australian University Librarians, Canberra.

Figure 1.2 Serial and monograph prices to Australian research libraries, 1986-98 – median values (per cent change)



Note: Preliminary data.
Source: CAUL (1999) *CAUL Statistics*, Council of Australian University Librarians, Canberra.

In Australia, price rises are exacerbated by the trend decline of the Australian dollar against the currencies in which scholarly publications are purchased – principally the US dollar and pound sterling. For example, the Australian dollar was worth an average of $US 1.25 during the 1970s, an average of 89.3 cents US during the 1980s, an average of 69.9 cents US during the 1990s and is now worth less than 60 cents. So over the last 30 years the Australian dollar has declined by more than 50 per cent against the US dollar.

In the context of constrained budgets, rising scholarly output, and the need to make new kinds of digital materials available in addition to traditional print materials within those budgets, many research libraries have been forced to shift resources from monograph and textbook purchases to serials, postpone subscriptions to new journals, rationalise their journal portfolios through cancellation of subscriptions and rely increasingly on inter-library loans and document delivery services.[17] In 1998-99, the value of journal cancellations in Australian university libraries was estimated to be $15 million.[18] Clearly, if it continues, this will tend to degrade access to scholarly information and make it more difficult for Australian researchers, educators and professionals to stay in touch with world leading scholarship.

The literature examining the issue of journal prices appears divided over its causes. Some say that commercial publishers have increased their market power and are pushing up prices – using monopoly power to generate rents.[19] Others say that the increase in the number of new titles over time lowers the average circulation of journals and thereby raises fixed costs (first copy costs) as a proportion of total costs.[20] In his analysis of biomedical journal titles, Mark McCabe suggests that both may be true. He found that after controlling for the suggested scale economies exhibited by individual titles there remains an unexplained inflation residual, which he attributes to the monopoly power of the large commercial publishers.[21]

McCabe found that prices were positively related to portfolio size, and that in the specific case of the merger of Wolters Kluwer and Waverly his model predicted an average price rise of between 20 and 30 per cent. McCabe was also able to show that past mergers were associated with higher prices – the Elsevier/Pergamon deal resulted in an average journal price increases of 22 per cent for former Pergamon titles, and 8 per cent for Elsevier titles.[22] Moreover, the largest commercial publishers (large in the sense of portfolios of titles) appear to be price leaders, pulling others' prices up.

But the issue is *not simply* about prices and the possible abuse of monopoly power. It is deeper than that. Indeed it goes to the heart of the scientific process itself – a process that depends heavily upon the ready exchange of information, rapid and wide dissemination of research findings.[23] And it goes to the heart of the emerging knowledge-based economy – in which prosperity depends increasingly upon the knowledge distribution power of the national innovation system.

1.3 The aim

The underlying aim of this discussion paper is to develop a shared picture of the scholarly communication 'industry' as a starting point for analysis. In it, we look at:

- what is happening in scholarly communication;
- how the scholarly communication system works;
- the scope of activities within the system;
- the relationships between players in the system;
- the cost and incentive structures underpinning the creation, production and distribution of scholarly content; and
- the underlying economics of the system.

Our purpose is to describe and scope the present system of scholarly communication, and explore the economics that govern it.

2 The Scholarly Communication System

In this chapter we describe our approach to analysing the scholarly communication system, and then characterise the main elements of that system.

2.1 The product systems approach

There are a variety of ways of thinking about industries which are relevant to this study. Traditional industrial classification pictures industries as groupings of enterprises engaged in the production of similar goods or services by means of similar production processes. In such a view, industries are seen as more or less isolated. The traditional method of exploring linkages between industries is Input-Output analysis, which examines the flows of goods and services between industries in an economy based on market transactions. A major limitation of the Input-Output approach is that it sees only market transactions. Given the importance of non-market and semi-market organisations in the scholarly communication system such an approach is not appropriate.

More recently, various methods for approaching industrial analysis have been developed in answer to specific problems. Collectively they can be thought of as various forms of cluster analysis. Some look at clusters as foci for locational and regional development,[24] others focus on sectoral innovation systems (sector or industry specific subsets of national innovation systems)[25] or complex product systems (complex, project-based, rather than mass production systems).[26] Of these, the product systems approach seems the most appropriate method to approach an analysis of the scholarly communication system.

Mapping product systems has developed from work at the United Kingdom's Complex Product Systems Innovation Centre, and has enjoyed a variety of international applications.[27] It is a technique that focuses on linkages between all the actors in a complex system that affects the transformation of activities and materials into goods and services through the processes of *creation, production* and *distribution*. Importantly in examining the economics of scholarly communication, the product systems approach enables us to distinguish between, rather than confuse, the economics of each phase of the product system – namely creation, production and distribution.

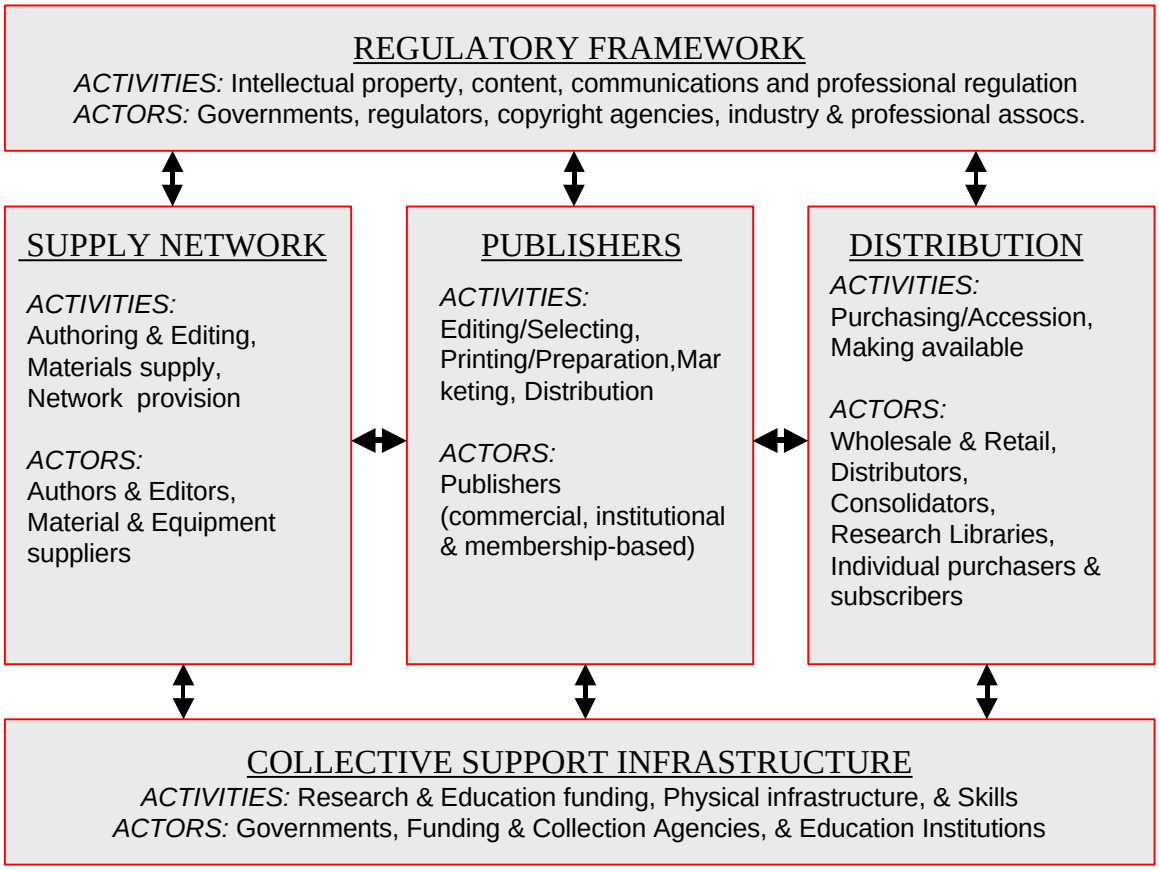
The product system approach is a recent form of the systems perspective, which has a long history in a wide range of analytical applications. In the late 1970s, Donald King undertook a number of studies for the United States National Science Foundation which focused on scientific scholarly journals. These studies pioneered systems analysis in the field of scholarly communication. They identified and characterised the principal functions performed in the scientific journals system, the participants involved, and attempted to quantify the outputs produced and resources used in the system.[28] While the product system approach employed here is somewhat broader in its scope, and

oriented more specifically to industry analysis, it can be seen as a development of these earlier studies.

2.2 The scholarly communication product system

The scholarly communication product system includes five major elements (shown in figure 2.1). Across the centre are those engaged in the creation, production and distribution of scholarly content. Their activities are supported by a collective support infrastructure, and subject to a shared regulatory framework.

Figure 2.1 The Scholarly Communication Product System



Source: Centre for Strategic Economic Studies (CSES).

At the centre of the scholarly communication product system are the *publishers* engaged in the production of content-based products and services. These include commercial, institutional and membership-based publishers (such as professional associations). The *supply network* includes the creators of content (authors and editors) and specialist suppliers of materials and equipment to the publishing and printing industries. The *distribution network* includes all the clients of publishers – 'the channel' (consolidators, aggregators, distribution agents, subscription agents, wholesalers and retailers); public

and private research libraries, State and National libraries, and document suppliers; and individual institutional subscribers and purchasers. These three groups form the core scholarly content value chain of creation, production and distribution.

The scholarly communication product system also involves a collective support infrastructure and an overarching regulatory framework.

The *collective support infrastructure* includes:

- the research and education funding agencies, which support the research and education activities that both produce and consume scholarly content;
- various kinds of infrastructure, including: research, education and library infrastructure (eg. buildings and equipment), information technology infrastructure (eg. internet, network equipment and services), and reproduction rights and collection agencies (eg. CAL, Australia's copyright collection agency); and
- the education and training infrastructure, including a range of technical and professional training institutions (eg. library schools).

The *regulatory framework* for scholarly communications includes:

- intellectual property regulation (eg. copyright and licensing);
- content regulation (eg. censorship, privacy, etc.);
- telecommunications and broadcasting regulation; and
- professional regulation (eg. professional qualification standards, regulated access to practice as a professional, and professional codes of conduct).

Hence, the scholarly communication product system includes all the activities and all the actors (stakeholders) involved in the creation, production, distribution and consumption of scholarly content.

3 The Scholarly Communication Product System

In this chapter we describe the scholarly communication product system focusing on the core value chain of content *creation* (authoring and editing), *production* (publishing) and *distribution* (especially by research libraries). We examine each section of the product system in turn, looking at the actors and activities involved.

3.1 The supply network (Creation)

The scholarly communication supply network involves two major sets of actors. Namely, content creators and editors, and materials and equipment suppliers.

3.1.1 Content creation

Academics and researchers are both creators and users of scholarly content. In this section we look at the nature and scope of their activities.

3.1.1.1 Journals

Journal content creation depends upon authors and editors. Authors create papers, while editors create journals – both in the sense of individual editions and titles.

3.1.1.1.1 Authors and editors

Authors are typically individual scholars or practitioners in the field. Most are employed by universities, public or private research institutes, or private companies. They generate scholarly content for a variety of reasons, including: the desire to report the findings of their research and lay it open to peer scrutiny; the desire to claim originality for the work and findings, and possibly lay claim to intellectual property rights in related concepts, tools, frameworks, or theories; and, somewhat less generously, the desire to maintain a publishing record in the field for the purposes of academic recognition, career advancement or simply to gain a promotion or pay rise.

Authors are typically supported by their employing institutions, and are rarely paid by the publishers for their work. In fact in some cases, authors are required to pay towards the publication of their work. Hence, in effect, the research and education funding that supports their work also supports the creation of scholarly content upon which publishers depend. Indeed, scholarly content can be seen as the material product of the research enterprise, and to a lesser extent of the necessary effort to maintain the capability to undertake the education enterprise. It, and intellectual property rights in it, are given away in return for publication and dissemination.

Journal editors are typically scholars or practitioners in the field of study relevant to the journal title. They are often the source of new title development (new journals), they act as editors of specific journals over a period of time, and/or sit on editorial boards and undertake regular review activities.

The editor of an academic journal typically undertakes the activity unpaid by the publisher or he/she may be paid a relatively small sum in the form of an honorarium, such that the activity is often supported in significant part by the editor's employing institution – university, research centre or other organisation. Typically an editor might be assisted by 2 or 3 clerical staff, who may be supported by the publisher, but are more commonly supported in whole or part by the editor's employing institution. In addition to this, there will be an editor/manager and small clerical team assigned to each journal title within the publishing organisation. The costs of editorial activities are, therefore, not typically borne in whole by the publisher, but rather shared between the publisher and the editor's employer – as an opportunity cost.

Members of editorial boards and reviewers are also typically scholars or practitioners active in the field. They are rarely paid by the publisher, undertaking the work instead as an integral part of their 'job' as academics, researchers or other practising professionals. While there is significant variation between fields, a relatively high proportion of academics and researchers are engaged in editorial activities as members of editorial boards – although many may not be actively involved.

New titles are usually developed by scholars. They may feel that there is no suitable outlet for their work and that of those around them, and/or that there is a new and important area of research opening up which requires a new outlet. In response to this situation some promote the idea of a new journal, discuss it in their professional network, and put a proposal for the development of a new title to a potential publisher. Less commonly, potential editors are approached by commercial publishers with an idea for a new title. Hence, most of the ideas for, and work involved in, the creation of new titles is performed by independent content creators rather than the publishers, and it too is supported by their employing institutions and funders.

3.1.1.1.2 Payment and reward

While publishers rarely pay the whole attributable cost of authoring, editing or reviewing in a direct monetary sense, content creators derive a number of non-monetary benefits. Principal among these is the recognition and status derived from these activities, and the contribution that that makes to their career advancement. This recognition and status also accrues, in part, to their employing institutions, and affords some recompense for the institutional support of the activities. Publishers also put some money back into the academy through such means as the sponsorship of conferences and payment of royalties to professional and academic societies.

Other benefits for content creators include the development of a scholarly network for which the editor provides a focal point around which the editorial board members, reviewers, regular contributors, subscribers and regular readers orbit. The receipt,

typically by the author(s), editor and members of the editorial board, of 'free' copies of the journal reinforces this network and constitutes some partial recompense in the form of subscription expenditure saved.

Personal experience relating to a relatively low circulation social science journal suggests that there may be quite a few 'free' copies circulating in the system. Journal X had a total subscription base of 800 in 1998, of which 704 were institutional subscriptions and 96 individual. During the year 92 sample copies were given away on request, and approximately 40 copies of each issue were circulated among the editorial board. And 1998 was a very slow year for sample copies. No fewer than 332 were given away in 1997 when there were 852 subscriptions. If editorial board 'free' copies are included, of the 10,144 copies circulated in 1997 some 770 or 7.6 per cent were given away.

A number of publishers also offer discounts to their journal contributors and authors. For example, contributors to Elsevier Science books or journals are entitled to a 30 per cent discount on the company's books (not journal subscriptions).

3.1.1.2 Texts and monographs[29]

Book authors are also typically scholars or practitioners in the field. Their motivations and rewards are much the same as they are in creating journal papers. Publication brings professional recognition, prestige and rewards in the form of career advancement. As is the case with journal papers, publishing through a prestigious publisher is widely perceived to be better than using a lesser known publisher – in terms of status, not simply extent of sales. The occasional exception might be in cases of very successful textbooks, which sell widely and generate significant royalties for authors.

Unlike journal papers, however, the editorial work of selection and quality control falls to the publisher and is usually performed in-house, and book authors usually share in the revenue derived from the sale of the book – earning a royalty which is typically of the order of 5 to 20 per cent of net revenue.

3.1.1.3 Databases and datasets[30]

With rapidly increasing quantities of information and advances in data collection technologies and capabilities, databases are an increasingly important area of information publication. Many commercial database builders obtain their raw materials (content) for free, adding value in the creation of metadata, quality control, editing and providing search engines and access capabilities which make the information accessible. Indeed, packaging and commercialisation of what was previously often publicly available data is actively encouraged by many governments and public sector agencies.

One example of this is remote sensing data. AUSLIG has been established in Australia to ensure that fundamental geographic information is available for the benefit of the community, and provide a national focus and impetus for commercialisation. AUSLIG provides opportunities for: industry to develop innovative commercial products based

on AUSLIG's raw map and satellite image data through 'Value Added Reseller' agreements; industry to further develop capabilities, including the uptake of more efficient technology; and ensure that the needs of regional Australia are met by providing a valuable tool for programs undertaken in regional areas – eg. Landcare.[31] Similar information businesses are being developed on the back of Australian Bureau of Statistics (ABS) data collections, and such environmental databases as ERIN.

Existing, major commercial database suppliers are in the vanguard of what is likely to become an increasingly important area of information commercialisation and dissemination.

3.1.2 The scope of content creation activities

The activities described above occupy a large number of people and consume both time and financial resources. In this section we look at the scope of those activities in Australia.

3.1.2.1 Academics (Education)

In 1998, there were a total of 76,272 people employed in higher education in Australia, of which 32,663 were academic staff.[32] Using a somewhat narrower definition of higher education, DETYA reported 69,252 full-time equivalent staff in higher education in 1999, of which 29,748 were academics.[33] In the same year Australian Universities spent some $5 billion on 'academic activities'.[34]

Students, especially post graduates, constitute the other major group of consumers and potential creators in Australia's education system. There were around 686,000 tertiary students in Australia in 1998, of whom 37,175 were doing higher degrees by research, a further 55,465 were undertaking higher degrees by coursework, and a total of almost 140,000 were post graduates.[35]

Hence, in higher education alone, there are around 170,000 potential creators and consumers of scholarly content, with some $5 billion spent annually on academic activities.

3.1.2.2 Researchers (Research)

In 1996-97, a total of $8.7 billion was spent on, and 90,519 person years were devoted to, R&D in Australia – 42,739 or 47 per cent by higher education institutions, 26,138 or 29 per cent by business, 10,342 or 11 per cent by the Commonwealth Government, 9,176 or 10 per cent by State governments, and 2,124 by private non-profit organisations. Gross expenditure on R&D has more than doubled and human resources devoted to R&D have increased by 37 per cent since 1988-89.[36]

Hence, there are at least a further 47,800 potential scholarly content creators and consumers engaged in R&D outside higher education institutions, with annual expenditures of some $6.4 billion on their R&D activities.

3.1.2.3 Professionals

It is impossible to put an exact figure on the number of people working in the professions in Australia who could also be counted among potential creators and consumers of scholarly content. However, some sense of the potential scale of activities can be gained when one considers that in 1996 there were some 327,000 education professionals, 274,000 health professionals, 122,000 engineering and construction professionals, 125,000 science and engineering associate professionals, and 50,000 health and welfare associate professionals. Some proportion of these professionals might also be counted among potential content creators and consumers.[37]

3.1.2.4 Scholarly publication

In the four years to 1994, Australian authors produced an average of 14,600 scientific papers per year. Book registrations suggest that Australians produce around 30,000 titles a year – a figure which does not include significant direct publication overseas, self publication and direct online distribution. Of these, as many as 20 per cent could be scholarly and professional titles.

3.1.2.4.1 Books

UNESCO compile international book title output statistics, which show that more than 100,000 book titles were produced in the United Kingdom and China during 1996 (the last year for which data are available). Other major producers are Germany (71,000 titles), the United States (68,000), Japan (56,000), Spain (46,000), France (35,000), Italy (35,000) and the Netherlands. In 1996, Australia ranked 21st in a table of international book title producers, with around 12,000 titles – putting Australia on a par with Poland and Iran.[38]

Table 3.1 Australian book and serial registrations, 1990-99 (new titles)

Year	*Books ISBN registrations (New Registrations)*	*Serials ISSN registrations (Total)*	*Serials ISSN registrations (Implied Additions)*
1990	6,703	-	-
1991	6,937	23,811	-
1992	7,714	27,382	3,571
1993	8,139	28,399	1,017
1994	8,398	29,540	1,141
1995	9,360	30,307	767
1996	12,208	32,392	2,085
1997	11,654	32,981	589
1998	15,413	35,559	2,578
1999	29,546	36,839	1,280

Sources: ISBN Agency, ISSN Registry and National Library of Australia.

While these data are far from complete they suggest a worldwide production of more than 1 billion book titles per year. Professional and education titles account for around

20 per cent of United States book sales by value, suggesting that there may be 200 million scholarly book titles produced worldwide each year.

In Australia, ISBN registration of book titles is one indicator of book production. It does not include all books produced, but does include most titles from major publishers. ISBN registration have increased rapidly during the 1990s, from just 6,703 in 1990 to no less than 29,546 in 1999. Much of the increase is recent, with just 11,654 titles registered in 1997.[39]

3.1.2.4.2 Journals

Ulrich's International Periodicals Directory lists more than 240,000 serials titles published throughout the world, of which 18,422 are refereed serials (approximately 8 per cent). The increase in number of titles over time is reflected by Ulrich's listing just 8,503 serials that have ceased publication during the last three years.[40] The global ISSN register of serials contained 945,973 records in 1999, of which an estimated 65 per cent, or 612,000 were current. Just over 51,000 were added during the year.

In Australia, ISSN registrations (total registrations) reached 36,839 in 1999, up from 23,8111 in 1991. Table 3.1 (above) shows total Australian ISSN registrations and implied annual additions between 1991 and 1999. Almost 1,300 new Australian serials titles were registered during 1999, and almost 2,600 new titles were registered during 1998. Australian serials titles registrations accounted for 3.9 per cent of world total in 1999, down from 4.1 per cent in 1991; but 10 per cent of English language registrations, up from 9.7 per cent in 1991.[41]

Table 3.2 Australian higher education published output, 1994

Category	*Sciences*	*Social Science & Humanities*	*Total*
Books	625	1,756	2,381
Edited books	521	605	1,126
Book chapters	1,695	3,202	4,897
Journal articles	13,666	9,984	23,650
Review articles	217	436	653
Conference papers	7,186	3,348	10,534
Creative works	80	1,823	1,903
Patents	100	1	101
Other	231	306	537
Total	24,320	21,460	45,780

Note: Higher education publications for 1994 reported to DETYA for the calculation of research quantum.
Source: Bourke, P., Butler, L. and Biglia, B. (1996) *Monitoring Research in the Periphery: Australia and the ISI Indices*, Research School for Social Sciences, Australian National University, Canberra, p61.

Over the period 1981 to 1994 Australian authors produced 2.14 per cent of the world's scientific papers, and received 2.07 per cent of the world's scientific citations. As a producer of scientific papers over that period Australia ranked 8th among the countries of the world. In some areas Australia is a very significant producer of scientific papers.

For example, Australia produces around 4.6 per cent of the world's papers in geoscience.[42]

In 1994, authors in Australian higher education alone published 3,500 books, almost 5,000 book chapters, 23,650 journal articles, 653 review articles and more than 10,000 published conference papers.[43] This does not include professional publication in government, specialist public and private sector research organisations or in law, medicine, engineering or other fields in which industry employed professionals publish.

These numbers demonstrate that Australian scholarly content creation is a significant activity, involving considerable financial and human resources. While it is impossible to quantify accurately, it is clear that scholarly content creation involves up to 200,000 Australians, whose activities are supported by annual expenditures well in excess of $10 billion, in the publication of at least 25,000 academic papers and as many as 5,000 books each year.

3.1.3 Materials and equipment suppliers

The other major group of actors in the supply network are materials and equipment suppliers. These can be divided into three sub-groups: suppliers of printing related materials and equipment; suppliers of equipment, software and services to facilitate electronic publication and distribution; and general office and administrative suppliers.[44]

3.1.3.1 Publishing materials and equipment suppliers

There is a number of more or less specialist suppliers of materials and equipment to the printing and publishing industries. They range from the suppliers of paper, through suppliers of printing machinery and equipment, and the software and services involved in the processes of formatting, typesetting, proofing, and so on.

Printing machinery and equipment manufacturing is a subset of industrial machinery and equipment manufacturing – an industry that employed more than 13,500 people in Australia in 1997-98, and realised a turnover of almost $1.7 billion. Paper and paper product manufacturing employed more than 17,000 people in Australia in 1997-98, and realised a turnover of $5.2 billion. Paper stationery manufacturing employed a further 8,500 people and realised a turnover of $1.2 billion.[45] While only a subset of these activities can be attributed to scholarly communication, it is clear that supply network industries are significant players in the Australian economy.

3.1.3.2 Printing and services to printing

The printing industry (including newspaper printing) employs more than 40,500 people in Australia, and has a turnover of $5.4 billion. Specialist services to printing employ a further 7,460 people and turnover almost $700 million a year.[46] Again, these are very significant activities within the economy.

3.1.3.3 Electronic publishing equipment, software and services

With increasing attention being paid to electronic publishing it is likely that those in the supply network focusing more specifically on electronic publishing supplies will play a part in innovation within the scholarly communication product system. The equipment is, of course, the same Information and Communication Technology (ICT) equipment used in a wide variety of applications and in the global information infrastructure – including servers, hubs, bridges, routers and the full range of network equipment. The Australian market for ICT equipment was worth around $11.4 billion in 1998, and that for network based content (excluding advertising) was worth some $5.7 billion. Much is imported, Australian-based ICT equipment manufacturers generated revenues of $4.8 billion in 1995-96, and employed more than 22,000 people.[47] Much of the software used is also general purpose. However, there are a number of service providers specialising in formatting, typesetting and related activities, and some more specialised vertical software suppliers serving the publishing industries.

3.2 Production (Publishing)

In this section we look at the publishers (actors) and then at the publishing processes (activities) involved in the production of scholarly content. We also take a brief look at the scope of publishing activities in Australia.

3.2.1 Publishers

There are commercial, institutional and membership-based publishers of scholarly content. While their motivations may be different, their production processes, their costs and the economics they face are broadly similar.

Publishing is a global industry, with something like 20,000 publishers serving 6,000 or more university and research libraries worldwide in a market worth around $US 5 billion annually.[48] The publishing industry, especially that directed at scholarly publishing, has an uneven structure, with a few very large commercial publishers and thousands of smaller, local and niche publishers. Moreover, within this structure there is considerable specialisation, such that industry concentration is significant in particular fields of publishing and specific market segments. The following sections characterise the publishing activities of each of the major types of publisher.

3.2.1.1 Commercial publishers

Commercial publishers have emerged over recent years as the most significant players in scholarly publishing. Some have grown into major multinational companies, both organically and through mergers and acquisitions. For example, Reed Elsevier employed some 26,000 people worldwide in 1998-99, and realised a pre-tax profit of £773 million on turnover of £3.2 billion.[49] Academic Press is a member of the Harcourt Group which realised global revenues in excess of $US 2 billion in 1999. The Group's

worldwide scientific, technical and medical publishing revenues, of which Academic Press accounted for the major share, reached almost $US 700 million.[50] These companies demonstrate the scale of commercial scholarly and professional publishing.

Box 3.1 Commercial publisher: Reed Elsevier

Reed Elsevier's businesses employ around 26,000 people. Combined turnover reached almost £3.2 billion in 1998. The company strategy is to concentrate on publishing and information provision through international businesses with strong positions in large and growing markets. As well as maintaining its leading position in the scientific information market, Reed Elsevier is developing its interests in professional and business markets.

Scientific publications realised £622 million or 20 per cent of total turnover and employed 3,500 people. Businesses in the Scientific segment publish more than 1,200 journals worldwide with more than 150,000 new research articles published each year in the physical, life, social and medical sciences, and operate an international network of medical communications services.

Professional publications include LEXIS-NEXIS, one of the largest databases in the world with over 10 terebytes of information providing access to more than 24,000 sources. Professional publication realised £1,154 million or 36 per cent of total turnover and employed more than 11,000 people word wide.

Business publications realised £1,387 million or 44 per cent of total turnover and employed 11,300 people worldwide. Combined, Reed Business, Cahners Business and Elsevier Business publications include a wide range of industry journals, magazines and newsletters, as well as business directories (including Kelley's and Kompass).

In 1998, the Reed-Elsevier group reported cost of sales (production) of £1.1 billion, distribution and selling costs of £714 million and administrative expenses of £992 million. They earned a pre-tax profit of £773 million, and enjoyed an operating margin of more than 25 per cent.

Source: Reed Elsevier (1999) *Reed Elsevier Annual Review 1998*. See http://www.reed-elsevier.com

Many of the major commercial publishers of scholarly journals have developed portfolios of journal titles. Some of which are quite general, but others span whole areas of scholarship. The emergence of these 'block' portfolios result from a number of forces, including economies of scale and the demand to create one-stop shop fronts for areas of related content. However, they also tend to create a partial monopoly in key areas of scholarly content – most especially in the sciences.[51] Many commercial publishers of books have also developed a strong presence in particular fields, using a similar portfolio approach.[52]

3.2.1.2 Institutional publishers

Most universities and many research schools operate publishing arms. Some are relatively small operations which seek to meet the need for institutional and local dissemination (eg. Victoria University Press), while others are major international publishers operating on a fully commercial basis (eg. Cambridge University Press). Many tend to focus on monographs and textbooks, rather than journals. University presses in Australia are much smaller than their counterparts in the United States and United Kingdom.

Box 3.2 Institutional publisher: John Hopkins University Press and Project MUSE

The Johns Hopkins University Press (JHUP) is one of the United State's oldest and largest university presses. It publishes more than 170 books each year and 52 scholarly journals. JHUP publications focus on such disciplines as literary studies, the classics, history, economics, political science, and the history of science and medicine.

Project MUSE was launched in 1995 as a joint initiative of the Johns Hopkins University Press and the Milton S. Eisenhower Library at Johns Hopkins University. The aim was to offer the full text of JHUP scholarly journals via the worldwide web. In 1999, Project MUSE published 46 JHUP titles in the humanities, social sciences and mathematics online. With the basic aim of readily accessible, low price online publication achieved, Project MUSE is now expanding.

During 2000 Project MUSE will add over 60 titles from other not-for-profit scholarly publishers, so that there will be 113 titles available. Other participating publishers include the university presses of: Carnegie Mellon, Duke, Indiana, MIT, Oxford, Pennsylvania State, Hawaii, Texas, West Virginia and Wisconsin. These will extend the disciplinary coverage to include: African-American literature, Asian culture and history, gender studies, medieval studies, higher education, health policy and political science.

There are now more than 700 institutional subscribers (no individual subscriptions are allowed). Access to the full database during 2000 costs $US 8,000 for larger academic and corporate institutions, and there are various packages and discounts available for smaller users.

Sources: Project MUSE at http://muse.jhu.edu and the Project MUSE Newsletter, *MUSE News*.

There are far too many university presses to present a full review. A few vignettes are presented in Appendix I to give some sense of the nature and scale of the activities of university presses.

3.2.1.3 Membership-based publishers

There are a number of membership-based publishers of scholarly content, of which most are professional and scholarly associations. Motivated by the values of

scholarship, many seek primarily to disseminate information rather than make a profit. Nevertheless, within the overarching 'not-for-profit' framework some associations use revenue derived from their publication activities to cross-subsidise other activities. Many charge 'commercial equivalent' prices. Hence, their production costs and pricing are more like their commercial counterparts than might otherwise appear to be the case.

Box 3.3 Association publisher: The American Institute of Physics

The American Institute of Physics (AIP) is a not-for-profit membership corporation chartered in 1931 for the purpose of promoting the advancement and diffusion of the knowledge of physics and its application to human welfare. Its mission is to serve the sciences of physics and astronomy by serving the Societies, by serving individual scientists, and by serving students and the general public. AIP has over 120,000 individual members.

AIP is a leading publisher of magazines and journals, including translations of research originally published in Russian. AIP publishes and distributes print and electronic journals of original research, reviews, and translations; conference proceedings, magazines; and electronic databases. Books under the AIP press imprint are published by Springer-Verlag through a licensing agreement. AIP publishes 67 journals. AIP's Conference Proceedings series offers a valuable archive of conferences, symposia, and workshops. Selected Proceedings' papers are included in SPIN™ and other major bibliographic databases, providing visibility to the larger scientific community.

AIP has published almost 460 volumes since 1970 – 40 in 1998. AIP's Translation Program produces virtually simultaneous English versions, in print and online, of eight Russian journals.

In 1998, AIP earned almost $US 52 million from its publishing activities – 79 per cent of its total annual revenues. Publishing expenses were reported to be $US 44.4 million for 1998, implying a 16 per cent operating margin.

Source: http://www.aip.org

There are hundreds, if not thousands of associations that publish journals on a scale ranging from the globally significant to very local and modest. A number also offer avenues for monograph and textbook publication.[53]

3.2.2 The publishing process

In this section we focus on the process of production of academic journals – looking at the steps typically involved. The process of book production is similar, and is dealt with briefly at the end.

Drawing on a range of sources, we can summarise the process of production of academic journals as follows:[54]

- The author(s) send approximately three copies of their paper to the editor of the journal they have targeted, having prepared it following the style guide for submissions;
- The editor assigns each manuscript to approximately three referees, who are often members of the editorial board, but may in some cases be other scholars or practitioners in the field;
- The referees read and assess the paper, following guidelines set out by the journal editor, and report back to editor;
- On the basis of the referees' reports the editor makes a judgement on inclusion or rejection of the paper, or may write to the author(s) requesting a rework of the paper along lines suggested by one or more of the referees;
- Typically the author(s) then do some further work on the substance of the paper and on re-formatting before final submission to the editor;
- The author(s) are sent a copyright agreement form, and must sign and return it as a precondition of publication – authors assign copyright to the publisher;
- The article is then copyedited and graphics, formulae, etc. are prepared for publication;
- It is then typeset, often by outside professionals on a contract basis;
- Proof sheets of the typeset paper are then sent to the author for final checking;
- If required, corrections are then made by the typesetter;
- The paper is then sent into production – it is printed and bound into the collection of articles making up that edition of the journal.
- In a parallel process, title pages, information and advertising pages, and indexes are created by the publisher and are typeset, proofed, corrected, printed, bound, etc.
- An agreed number of off-prints of their individual papers are prepared, packaged and sent to all contributing authors (free).
- Individual copies are then mailed out directly to customers or to distribution and/or consolidation agents.

To be able to support these production steps publishers must:

- Maintain up-to-date subscription information, including payment status and addresses for all subscribers to each individual title;
- Undertake a range of marketing activities;

- Expend editorial effort in identifying and selecting titles from the suggestions sent to them by scholars, and/or pursuing scholars to suggest the development of new titles and establish their interest in editorial activities; and
- Undertake all the usual management and administrative activities, and bear the overheads involved in operating any significantly sized organisation.

The process of production for textbooks and monographs is similar to that outlined above, but there are some important differences. Chief amongst these differences is that for books the editorial process is typically done entirely by the publishing company, in-house.

The processes of production of databases and datasets are still evolving. They are so varied as to defy a brief, succinct description.

3.2.3 The scope of publishing activities

The Literary Market Place information service lists 14,800 international publishers. Of these 3,246 were in the United States, 1,596 in Germany, 1,151 in the United Kingdom, and 243 in Japan. There are 547 publishers listed in Australia.

There are a relatively small number of large multinational commercial publishers operating very significant businesses – businesses with market capitalisation and annual revenues from publishing worldwide in the billions. Reed Elsevier group revenue for 1999 amounted to more than $8 billion, and Wolters Kluwer's to $5 billion (at current exchange rates) – just to cite two examples. Below this there are many thousands of smaller, specialist and niche publishers, serving a world market for scholarly content worth perhaps $US 5 billion.[55]

3.2.3.1 Publishing

As noted above, there are around 1 billion books titles produced worldwide each year, and as many as 200,000 periodicals in existence. Publishers enjoy much larger book and periodical sales (selling multiple copies of individual titles). Most university presses and association publishers are not included in manufacturing industry censuses of publishing, making it impossible to obtain accurate information of world book or periodicals sales. However, in 1998, United States book publishing industry sales amounted to $US 23 billion, of which professional publications accounted for $US 4.4 billion, and registered university presses a further $US 392 million. United States domestic book purchases amounted to 2.4 billion units (books).[56]

The Australian printing, publishing and recorded media industries employed more than 100,000 people in 1998, and realised an industry gross product of $6.8 billion on turnover of more than $15 billion. Turnover, gross product and employment have all increased steadily during the 1990s, with employment up by around 10 per cent between 1992 and 1998, and turnover up 27 per cent. Printing, publishing and recorded media

industries sales were $10.7 billion in 1997-98, 4.6 per cent or $490 million of these were exports.[57]

Table 3.3 International book publishers, by country (number of publishers)

Afghanistan(6)	Albania(5)	Algeria(3)	Angola(1)
Antigua & Barbuda(1)	Argentina(129)	Armenia(2)	Australia(547)
Austria(207)	Azerbaijan(2)	Bahrain(2)	Bangladesh(12)
Barbados(2)	Belarus(9)	Belgium(195)	Benin(2)
Bermuda(1)	Bolivia(8)	Bosnia & Herzegovina(3)	Botswana(6)
Brazil(225)	Brunei Darussalam(1)	Bulgaria(82)	Burkina Faso(1)
Burundi(3)	Cameroon(6)	Cape Verde(1)	Central African Republic(1)
Chad(1)	Chile(44)	China(123)	Colombia(58)
Congo (9)	Costa Rica(38)	Cote d'Ivoire(7)	Croatia(34)
Cuba(16)	Cyprus(17)	Czech Republic(117)	Denmark(109)
Dominican Republic(5)	Ecuador(17)	Egypt (19)	El Salvador(4)
Estonia(21)	Ethiopia(3)	Fiji(5)	Finland(59)
France(662)	French Guiana(1)	French Polynesia(3)	Gabon(1)
Gambia(1)	Georgia(3)	Germany(1596)	Ghana(37)
Greece(131)	Guadeloupe(1)	Guatemala(5)	Guinea-Bissau(1)
Guyana(7)	Haiti(4)	Vatican City (5)	Honduras(3)
Hong Kong(78)	Hungary(70)	Iceland(30)	India(262)
Indonesia(70)	Iran, Islamic Republic of(5)	Iraq(1)	Ireland(91)
Israel(140)	Italy(630)	Jamaica(26)	Japan(243)
Jordan(4)	Kazakstan(6)	Kenya(47)	Korea (11)
Korea, Rep Of(119)	Kuwait(3)	Laos (2)	Latvia(18)
Lebanon(19)	Lesotho(4)	Libyan Arab Jamahiriya(1)	Liechtenstein(19)
Lithuania(36)	Luxembourg(26)	Macau(4)	Macedonia (19)
Madagascar(15)	Malawi(6)	Malaysia(65)	Maldive Islands(2)
Mali(2)	Malta(8)	Martinique(3)	Mauritania(1)
Mauritius(11)	Mexico(159)	Moldova, Republic of(3)	Monaco(9)
Mongolia(2)	Morocco(17)	Mozambique(5)	Myanmar(9)
Namibia(12)	Nepal(3)	Netherlands(234)	Netherlands Antilles(3)
New Caledonia(2)	New Zealand(143)	Nicaragua(2)	Niger(1)
Nigeria(62)	Norway(59)	Oman(1)	Pakistan(45)
Panama(3)	Papua New Guinea(11)	Paraguay(4)	Peru(20)
Philippines(45)	Poland(81)	Portugal(142)	Puerto Rico(13)
Reunion(2)	Romania(72)	Russian Federation(94)	Rwanda(3)
Samoa(1)	Saudi Arabia(9)	Senegal(12)	Sierra Leone(4)
Singapore(48)	Slovakia(34)	Slovenia(11)	South Africa(88)
Spain(546)	Sri Lanka(38)	Sudan(3)	Suriname(18)
Swaziland(1)	Sweden(134)	Switzerland(378)	Syrian Arab Republic(4)
Taiwan(66)	Tajikistan(1)	Tanzania(27)	
Thailand(32)	Togo(5)	Trinidad & Tobago(14)	Tunisia(20)
Turkey(51)	Turkmenistan(1)	Uganda(6)	Ukraine(11)
UAE(2)	United Kingdom(1151)	Uruguay(29)	Uzbekistan(2)
Venezuela(27)	Viet Nam(10)	Yemen(1)	Yugoslavia(40)
Zambia(19)	Zimbabwe(41)	Canada (333)	USA (3246)

Source: The Literary Market Place http://www.literarymarketplace.com

In 1997-98, publishing industries in Australia employed 41,900 people and realised turnover of $7.2 billion. Some 6,750 were employed in periodical publishing (excluding

newspapers), and almost 5,400 were employed in book publishing. The turnover of periodical publishers was $1.1 billion, while that of book publishers was $1.3 billion.[58]

In 1997-98, there were 261 book publishers in Australia (businesses deriving the majority of their revenue from the publication of books). They employed an average of just 21.2 people. These businesses derived just over $1 billion from the sale of books. The sale of Australian titles realised $624 million or 60 per cent of total sales revenue. Royalties and fees paid by the industry amounted to $88.5 million, or 14.2 per cent per Australian book sale.[59]

There are a few large printers in the Australian book printing industry which dominate the printing of mono-colour paperbacks and casebound books on relatively long production runs. *The Pacific Magazine and Printing Group (PMP):* includes Griffin Press and Wilke and Company, and has printing operations in NZ, Indonesia, Singapore, Hong Kong and China. *McPherson's Printing Group*: includes The Book Printer, Macarthur Press, Globe Press, and Owen King Printers.[60]

Together, book and periodical publishing (excluding newspapers) in Australia employs some 12,160 people, generates industry gross product of $716 million on sales of some $2.4 billion. Clearly, publishing is a significant business activity in Australia.

3.2.3.2 Trade in publications

Books and periodicals trade data reflect the significance of the industry, and Australia's dependence on imported content. During calendar year 1999, Australia exported $135 million worth of books and periodicals, and imported $795 million.

Table 3.4 Exports of publications and printed matter from Australia, 1999 ($m)

Exported	*$m*
Printed books, brochures, leaflets and similar printed matter (excl. comics, dictionaries, encyclopaedias and serial installments)	29.3
Printed books, brochures, leaflets and similar printed matter nes	19.2
Printed books, brochures, leaflets and similar printed matter, in single sheets	15.9
Newspapers, journals and periodicals nes	14.9
Newspapers, journals and periodicals, appearing less than four times a week	14.5
Paperbound books and booklets, nes	12.8
Newspapers, journals and periodicals appearing at least four times a week	9.4
Dictionaries, encyclopaedias and serial installments	5.9
Books and booklets, hardbound and the like nes	4.9
Dictionaries and encyclopaedias, and serial installments thereof (excl. paper or unbound)	4.6
Paperbound or unbound dictionaries and encyclopaedias, and serial installments thereof	2.2
Comics and similar publications (excl. in single sheets)	1.1
Comics and similar publications nes	0.2
TOTAL	135.0

Source: TradeData (see http://www.tradedata.net)

Categories used in trade data make it impossible to distinguish scholarly from other publications, but it is clear that trade in such material is significant. Professional, higher education and university presses, as a group, account for 34 per cent of United States book sales and educational material and a similar share of Australian domestic book sales, so one might estimated that around $260 million of the publications imported into Australia could be considered a part of the scholarly communications system.

These data do not include individual items received by post, which with the increasing use of online bookstores are likely to be of growing importance. Amazon.com alone sold more than $600 million during 1988 and a recent *Publishers Weekly* survey suggested that online book sales rose 300 per cent during that year.[61] Euromonitor put 1999 global internet book sales at $US 2.9 billion. Nor do these data include online books or papers transferred across the internet as publications and/or grey literature, which is also a significant and rapidly growing part of the trade in publications.

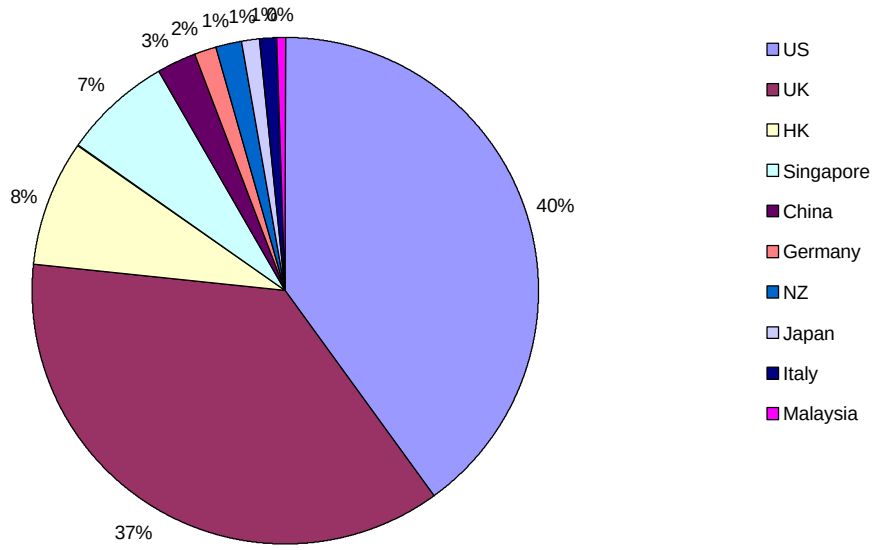
Table 3.5 Imports of publications and printed matter into Australia, 1999 ($m)

Imported	*$m*
Books, booklets, paperbound or unbound (excl. fashion books, dictionaries and encyclopaedias, and installments thereof, and Australian telephone directories and timetables)	252.1
Journals and periodicals, appearing less than four times a week (excl. fashion & comics)	230.5
Books, booklets, hardbound (excl. fashion books, dictionaries and encyclopaedias, and installments thereof)	162.3
Printed brochures, leaflets and similar printed matter (excl. those in single sheets)	130.1
Printed books, brochures, leaflets and similar printed matter, in single sheets	7.5
Comics and similar publications, appearing as journals or periodicals	6.4
Dictionaries and encyclopaedias, and serial installments (excl.single sheets)	3.5
Fashion books	1.5
Fashion periodicals	0.9
Newspapers appearing less than four times a week	0.1
Australian telephone directories and Australian timetables	0.02
Newspapers, journals and periodicals appearing at least four times a week	0.02
Total	794.9

Source: TradeData (see http://www.tradedata.net)

The United States and United Kingdom are by far the most important sources of imports of published and printed matter into Australia, accounting for a combined 77 per cent of total imports in 1999. Hong Kong and Singapore are also major source. New Zealand is the most important destination for Australia's exports of publications and printed matter, taking no less than 58 per cent of total exports in 1999. The United States and United Kingdom, taking 12 and 11 per cent of total, respectively, are the other major destinations.

Figure 3.1 Top 10 sources of imports of publications and printed matter into Australia, 1999



Source: TradeData (see http://www.tradedata.net)

US book exports were worth $US 1.8 billion in 1998, of which $US 542 million was for professional, technical and scientific books, and a further $US 332 million was for textbooks. Australia ranked 3rd as a destination for United States book exports, after Canada and the United Kingdom. However, Australia ranked 18th as a source of book imports into the United States – just behind Taiwan, and ahead of Colombia.[62]

3.3 Distribution (channel and clients)

The distribution of scholarly content involves research libraries, State and National libraries, the channel (wholesale, retail and distribution), and individual institutional subscribers and purchasers.

3.3.1 Libraries

Research libraries play an important role in the dissemination of scholarly publishing, through the provision on infrastructure, content, skilled support services and education and training in information access and retrieval. Less obvious is their role in selection and quality control. Professional library collection development plays an important part in sifting the enormous volume of information and providing authentication. In effect,

libraries provide a second line of defence, backing up peer review and publication processes.

The ABS reported 564 organisations in the library industry, operating from 1,468 locations and employing 11,877 people (as at June 1997). Total library industry income in 1996-97 was $667 million, of which 90 per cent was government funding. Expenses totalled $631 million, of which $327 million went on wages and salaries. In 1996-97, there were 89,564,600 visits to public libraries.[63] In addition to these are hundreds, if not thousands of specialist 'restricted access' libraries – including those government departments, in law firms, engineering and other technical and consulting services firms, public and private hospitals and clinics,[64] and company research centres. Many of these play a role in the dissemination of scholarly information. However, there are around 40 university libraries and perhaps 15 specialist public sector research libraries at the heart of the scholarly publications distribution system in Australia.

3.3.1.1 Research libraries

Australian university libraries currently spend some $94 million on serials subscriptions and $44 million on textbooks and monographs ('non-serials') each year. This represents 36 per cent of total university library expenditures.[65] These expenditures have increased significantly during the 1990s. In 1991, they spent $44.6 million on serials subscriptions, $34.1 million on monographs, and a total of $85 million on content materials. Hence, content expenditure by Australian university libraries increased by 61 per cent or $52 million between 1991 and 1998. Some $49 million of this increase occurred in serials expenditures, which now account for 25 per cent of total university library expenditure, compared to 17.5 per cent in 1991.[66]

Box 3.4 The University of Melbourne Library

The University of Melbourne employed 2,435 academic staff in 1998. There were 8,435 higher degree student and a further 24,080 other tertiary students attending the University. The total university population including all staff and students was 37,685.

In 1998, Melbourne University Library expenditure amounted to a little more than $24 million. Just over $12 million of this went on salaries for the Library's 260 staff, who operated its 25 libraries for an average of 83.5 hours per week. They processed a total of 1,459,088 loan transactions and supplied 16,820 items.

The Library held 2,214,195 non-serial items (principally books), and acquired 34,881 during the year – made up of 31,627 individual titles. Non-serials expenditure amounted to more than $3 million during 1998 – 13 per cent of total Library expenditure.

The Library subscribed to a total of 13,173 serials titles in 1998, but cancelled 2,416 subscriptions that year. Serials subscription cost the Melbourne University Library a little over $6 million during 1998 – 25 per cent of total Library expenditure.

Source: CAUL (1999) *CAUL Statistics*, Council of Australian University Librarians, Canberra.

Other major research libraries, national and state libraries are also major purchasers of scholarly information. For example, the National Library of Australia (NLA) spent almost $3.4 million on print and electronic content in 1997-98, of which $996,215 was spent on monographs, $2.26 million on print serials and $118,000 on electronic content – and this does not include the NLA's extensive legal deposits, gifts and donations (14,823 items were received through legal deposit during 1998-99). The NLA holds more than 2 million monographs, some 192,000 serials titles, and a range of other materials.[67] State libraries and specialist libraries, such as those at the CSIRO and ANSTO, are also significant players in the distribution of scholarly publications in Australia.

Box 3.5 The Commonwealth Scientific and Industrial Research Organisation (CSIRO)

CSIRO is the major multidisciplinary science research institution in Australia. Library and information services are an integral part of research support and are delivered through a network of libraries to approximately 6,500 staff across a range of disciplines.

CSIRO leverages its corporate purchasing power through central negotiation. A number of agreements for the purchase of scientific serial publications and electronic resources are managed corporately.[68] The figures below demonstrate the declining purchasing power of CSIRO's corporately managed serials expenditure over the period 1994-98. While expenditure remained constant in dollar terms, the number of subscriptions acquired decreased annually as the average price per serial increased.

	Value ($)	*Subscriptions*	*Average Price ($)*
1994	5,541,000	13,700	404.45
1995	5,628,000	12,200	461.31
1996	6,474,000	10,800	599.44
1997	6,019,000	9,700	620.52
1998	6,666,000	8,400	793.57
1999	6,873,000	8,615	797.79

In 1999, CSIRO invested in the information technology infrastructure to deliver large scale electronic resources to scientists, regardless of their location. The Elsevier collection of 1,200 or more journals was loaded locally in August 1999 and usage of electronic delivery has been very positive. 1999 figures demonstrate an arrest in the average price per title trend. CSIRO's strategy is to convert as many titles as possible to electronic delivery, and to attempt to increase title coverage to support research through the acquisition of complete publisher collections.

Source: CSIRO

3.3.1.2 Library users

Research libraries are the intermediaries; their clients are the academics, researchers and students for whom scholarly content is a major input.

As noted above, there were 32,663 academic staff in Australian higher education institutions in 1998, and almost 140,000 post graduate students. While academic staff numbers have not changed very much over the last decade, student numbers, especially higher degree student numbers, have skyrocketed. The number of research higher degree students in Australia has more than doubled over the last decade – from 14,751 in 1989 to 37,175 in 1999 – while the total number of postgraduate students has increased from 69,993 in 1989 to 139,528 in 1999.[69] Human resources devoted to R&D in higher eduction institutions increased by more the 70 per cent between 1988-89 and 1996-97. These data suggest a significant and increasing demand for scholarly content in the higher education sector.[70]

While records do not show exact expenditure on scholarly content by R&D organisations they do distinguish capital, labour and current expenditure. In 1996-97, just under $4 billion or 46 per cent of total R&D expenditure went to current expenditure – excluding labour costs, land and buildings and other capital expenditure on equipment. A proportion of this $4 billion would be attributable to scholarly content.[71] When one considers that in addition to this Australian university libraries spent almost $140 million on serials and monographs in 1998, it is clear that Australia's expenditure on scholarly content is significant.

3.3.2 The channel

Scholarly content represents a relatively small proportion of the general wholesale and retail channel for books and periodicals, but there are significant specialist bookshops and a number of specialised distributors, consolidators and subscription agents active in the scholarly communication industry.

3.3.2.1 General wholesale and retail

The last detailed survey of wholesale activities in Australia was undertaken in late 1992. At that time, wholesale sales of paper and paper products amounted to $1.46 billion, and wholesale sales of books and periodicals to $1.1 billion. The book and magazine wholesaling industry comprised 393 businesses, employed 5,853 people and realised an industry gross product of $252 million on turnover of $1.14 billion.[72] Book and magazine wholesaling accounted for just 1.5 per cent of total wholesaling industry gross product.

Surveys of publishers suggest that in 1994 Australian publishers enjoyed domestic book sales $760 million, plus some $80 million in exports. These publishers sold 125 million books, some 52 million of which were imported. There were a total of 13,741 titles published. It is estimated that 40 per cent, or $300 million, of book sales were educational – $167 million or 22 per cent of total book sales were in the tertiary education and professional and reference categories.[73] Sales of books by publishers increased from $760 million in 1994 to just over $1 billion in 1997-98. The average profit margin realised by book publishers in Australia in 1997-98 was 8.3 per cent.[74]

Retail sales of newspaper, books and magazines were worth $3.74 billion in 1991-92.[75] A survey of independent book sellers in 1997-98 reported total book sales of $1.1 billion, with academic and professional books accounting for 21 per cent of total sales. Australian books accounted for 43 per cent of sales.[76]

Box 3.6 Major subscription agents and consolidators

Swets Blackwell: Swets and Zeitlinger is a global organisation of Dutch origin active in the field of information services, publishing, and library supplies. Swets and Zeitlinger publish more than 40 English language scholarly refereed journals in education, engineering, humanities, life sciences, linguistics/language, and psychology; it is also a leading Dutch-language publisher in psychology, psychiatry, and education. Swets and Zeitlinger is the majority shareholder of Swets Blackwell, the merged Swets Subscription Service and Blackwell's Information Services, which is the largest subscription agent in Europe and one of the largest worldwide. Swets Blackwell offers a wide range of services and products in the area of professional serials management. Swets has over 1,000 staff worldwide, 22 offices in 19 countries, trades with 50,000 publishers and serves 50,000 customers throughout the world.[77]

RoweCom: provides an access point for the acquisition of information resources, including: magazines, newspapers, journals and books. RoweCom's flagship services, Knowledge Store (kStore) and Knowledge Library (kLibrary), provide convenient access, allowing clients to order, pay for and manage 240,000 titles online as well as millions of discounted books via RoweCom partner barnesandnoble.com. RoweCom focuses primarily on the corporate market, and has a number of high profile international corporate clients. Last year RoweCom acquired Australian-based International Subscription Agencies (ISA), United Kingdom-based Dawson Information Services Group from Dawson Holdings, and NewsEdge in a stock swap valued at $US 227 million. The units acquired from Dawson Holdings include Faxon, an academic subscription service provider. RoweCom generated an operating revenue of $US 308 million during 1999, realising an operating profit of $US 9.6 million with a margin of 3.1 per cent. With around 190 clients worldwide in 1998 RoweCom generated just over $US 100,000 in revenue from each client.[78]

EBSCO: provides subscription services focusing on the library and academic communities. Starting as one man selling magazine subscriptions door-to-door in the 1930s, EBSCO now claims to be the world's largest subscription management agency with 32 offices in 21 countries. EBSCO Subscription Services helps clients obtain and manage serials. Title searching, ordering, claiming and collection development support are all part of EBSCO's service. EBSCO produces indexing and abstracts for over 4,000 publications, full text for over 2,000 publications, is developer and producer of nearly 60 proprietary reference databases, producer of over 20 licensed reference databases, and creator of over 1,000,000 abstracts annually.[79]

Sources: Swets Blackwell, see http://www.swets.nl; Rowe, see http://www.rowe.com; and EBSCO, see http://www.epnet.com

3.3.2.2 Specialist distributors and subscription agents

There are a number of large specialist distributors of academic content. Services include consolidation of subscription lists and catalogues for journals as well as book sourcing for clients. It is a global business and as such tends to be dominated by a few large players, although, as there are in other areas of the scholarly communication system, there are many smaller players in the distribution business.

Table 3.6 International book distributors, by country (number of distributors)

Afghanistan(2)	Albania(1)	Angola(1)	Argentina(17)
Australia(37)	Austria(34)	Bangladesh(6)	Barbados(3)
Belgium(24)	Benin(1)	Bolivia(4)	Bosnia & Herzegovina(2)
Botswana(1)	Brazil(29)	Brunei Darussalam(1)	Bulgaria(1)
Burundi(1)	Cameroon(2)	Chile(11)	China(4)
Colombia(14)	Congo(1)	Congo(4)	Costa Rica(3)
Cote d'Ivoire(2)	Croatia(1)	Cuba(1)	Cyprus(3)
Czech Republic(3)	Denmark(13)	Dominican Republic(1)	Ecuador(9)
Egypt (5)	El Salvador(3)	Ethiopia(1)	Fiji(1)
Finland(5)	France(13)	Gambia(1)	Germany(34)
Ghana(7)	Gibraltar(1)	Greece(46)	Guatemala(3)
Guyana(4)	Honduras(1)	Hong Kong(3)	Hungary(2)
Iceland(3)	India(43)	Indonesia(8)	Iran(1)
Ireland(12)	Israel(21)	Italy(23)	Jamaica(4)
Japan(28)	Jordan(4)	Kenya(8)	Korea N (1)
Korea S(7)	Kuwait(1)	Latvia(1)	Lebanon(2)
Lesotho(2)	Liberia(1)	Lithuania(2)	Luxembourg(4)
Macedonia (2)	Madagascar(5)	Malawi(4)	Malaysia(13)
Mali(2)	Malta(4)	Mauritius(1)	Mexico(16)
Mongolia(1)	Morocco(7)	Myanmar(7)	Namibia(5)
Nepal(2)	Netherlands(20)	Netherlands Antilles(1)	New Caledonia(1)
New Zealand(23)	Nicaragua(2)	Nigeria(15)	Norway(16)
Pakistan(11)	Panama(2)	Papua New Guinea(1)	Paraguay(3)
Peru(11)	Philippines(10)	Poland(4)	Portugal(44)
Puerto Rico(3)	Qatar(1)	Reunion(2)	Romania(2)
Russian Federation(1)	Rwanda(1)	Saudi Arabia(3)	Senegal(1)
Sierra Leone(1)	Singapore(11)	Slovakia(1)	Slovenia(4)
South Africa(20)	Spain(19)	Sri Lanka(5)	Sudan(6)
Sweden(12)	Switzerland(14)	Syrian Arab Republic(1)	Taiwan (2)
Tanzania (4)	Thailand(9)	Togo(2)	Trinidad & Tobago(3)
Tunisia(4)	Turkey(4)	Uganda(1)	United Kingdom(156)
USA(301)	Uruguay(8)	Venezuela(5)	Yemen(1)
Yugoslavia(5)	Zambia(3)	Zimbabwe(5)	

Source: The Literary Market Place http://www.literarymarketplace.com

DA Information Services is among Australia's largest distributors. Other major players include: Bennetts (Australia), Baker and Taylor / Yankee Book Peddler (US), Blackwells Book Services (UK and US) and Dawsons (UK).

Publishers and their customers sometimes use subscription and consolidation agents to reduce the transaction costs involved in making many individual sales/purchases. Subscription agents (re)package subscription lists and publisher portfolios and make

available wider and different bundles of titles sourced from multiple publishers. Their business depends on bundling titles into more cost effective package deals for clients, and on obtaining discounts from publishers (typically of the order of 7 per cent). Consolidation agents often deal in geographic markets, collecting orders from clients outside that market and sourcing publications from within it. They then consolidate the order for particular clients and client groups and take advantage of bulk shipping opportunities.

3.3.2.3 Document delivery services

Specialist document suppliers and document delivery services have emerged to meet the needs of library, institutional and individual users for the delivery-to-order of individual published documents (eg. individual journal articles) and grey literature. With the increasing capacity to search for and discover information references, and the decreasing capacity of libraries and institutions to hold a full set of the world's scholarly output, document services are growing importance. One Australian university library reports spending more than $300,000 a year on UnCover alone – in that particular case equivalent to around 9 per cent of the library's total content expenditure.

Box 3.7 Major commercial document delivery services

UnCover: The CARL Corporation is a developer of solutions for libraries of all types. Over 1,000 libraries at 37 sites, including public libraries and library consortia, public school library systems, and academic libraries, use the CARL System – nearly 30 million library users. In addition to its main library system CARL has operated a number of other products, including: DIALOG@CARL, CARLweb, UnCover, Everybody's Catalog, Kid's Catalog, Everybody's Menu Builder, and Gateway Server products. UnCover is a database of current article information taken from over 18,000 journals. It contains descriptive information for nearly 9 million articles which clients can order in print or online on a pay-per-view basis, and is widely used in the academic market. CARL Corporation recently sold UnCover to Ingenta, a United Kingdom-based company which operates the BIDS online gateway for United Kingdom academics.

INFOTRIEVE: a research portal offering document retrieval and delivery services, current awareness alerts, databases on the web, and a variety of tools to simplify the process of identifying, retrieving, and paying for published literature. Through its network of library, archive, and publisher sources it can provide a copy of most published articles on an on-demand, pay-per-view basis. INFOTRIEVE charges $US9.75 (plus copyright charges) for each article, with some volume discounts available for major customers.

Sources: CARL Corporation, see http://www.carl.com; and Infotrieve, see http://www.infotrieve.com

Ulrich's *International Periodicals Directory* identifies 19 major document delivery services, including: the British Library Document Supply Centre (BLDSC), UnCover,

Ask IEEE, CINDOC, CISTI, Infotrieve, CatchWord and the German National Library of Medicine.[80]

3.3.2.4 Web-based serials, abstracting and indexing services

The trend away from physical holdings to access is also highlighted in the emergence of an increasing number of web-based serials content providers. Ulrich's *International Periodicals Directory* lists the following among the major web-based providers:

- HighWire Press, based at Stanford University;
- Project MUSE, based at Johns Hopkins University;
- CatchWord, a commercial web-based publisher;
- SciELO, a Latin American virtual library;
- JSTOR, an online journal archive; and
- NISC, a producer of CD-ROM and web-based databases;

The directory also list some 800 abstracting and indexing services.[81]

3.3.3 Individual purchasers and subscribers

Individual purchasers and subscribers make up the remainder of the clients. Most scholarly journals rely on institutional much more than individual subscriptions. While it varies significantly between fields, rarely would individual subscribers account for more than 10 to 20 per cent of total subscriptions. Association publications that circulate to individual members as a part of the professional association membership are the exception. Book sales, especially of more specialised monographs, also rely heavily upon institutional sales.

While they may not have been a major influence on the system to date, it is possible that with the advent of online bookshops, increasing use of online materials and growing confidence in the reliability and security of e-commerce, individual purchasers will increase their share of the market, bypassing institutional research libraries. Anecdotally, amongst research colleagues, there has been significant growth in online purchasing from the major online bookstores, such as Amazon.com and Barnes and Noble, and local specialist bookstores, such as Dymocks, as well as directly from commercial, university and association publishers.

According to a recent survey reported in *Publishers Weekly* the rise in online book selling is one of the most dramatic changes of the last few years. It suggested that online book sales from the major United States-based sellers rose 300 per cent during 1998 and were worth an estimated $US 650 million.[82] Growth and sales of that order would put current annual online book sales at over $US 2 billion. This number is confirmed by Euromonitor data that show total global retail sales of books in 1999 to have been $US 78.5 billion, with global internet books sales of $US 2.9 billion – 3.7 per cent of total.[83]

Such 'disintermediation' could become a major source of innovation, cost reduction and structural change in the scholarly communication system.

3.4 The collective support infrastructure

Like other such systems, the scholarly communication product systems draws on a collective support infrastructure. It includes a range of actors and activities involved in:

- education and research funding – agencies that support the education and research activities that both produce and consume scholarly content;
- the provision of various kinds of physical infrastructure – including: research, education and library infrastructure (eg. buildings and equipment), and information technology infrastructure (eg. internet, network equipment, software and services);
- collection and permission agencies – which provide vehicles for access to, and the distribution of, proceeds from the use of copyright materials in education and research institutions; and
- education and training infrastructure – including a range of technical and professional training institutions (eg. library schools).

Each plays a role in facilitating the operation of the scholarly communication system.

3.4.1 Education and research funding

Around $30 billion is spent on education, of which government outlays accounted for just over $25 billion; and some $8.7 billion is spent on R&D in Australia each year.[84] Clearly, these are large expenditures underpinning significant activities. Equally clearly, the number of people involved and levels of expenditure tell only a part of the story. The real economic significance of education and research is that they are the drivers of wealth creation in a knowledge-based economy.[85]

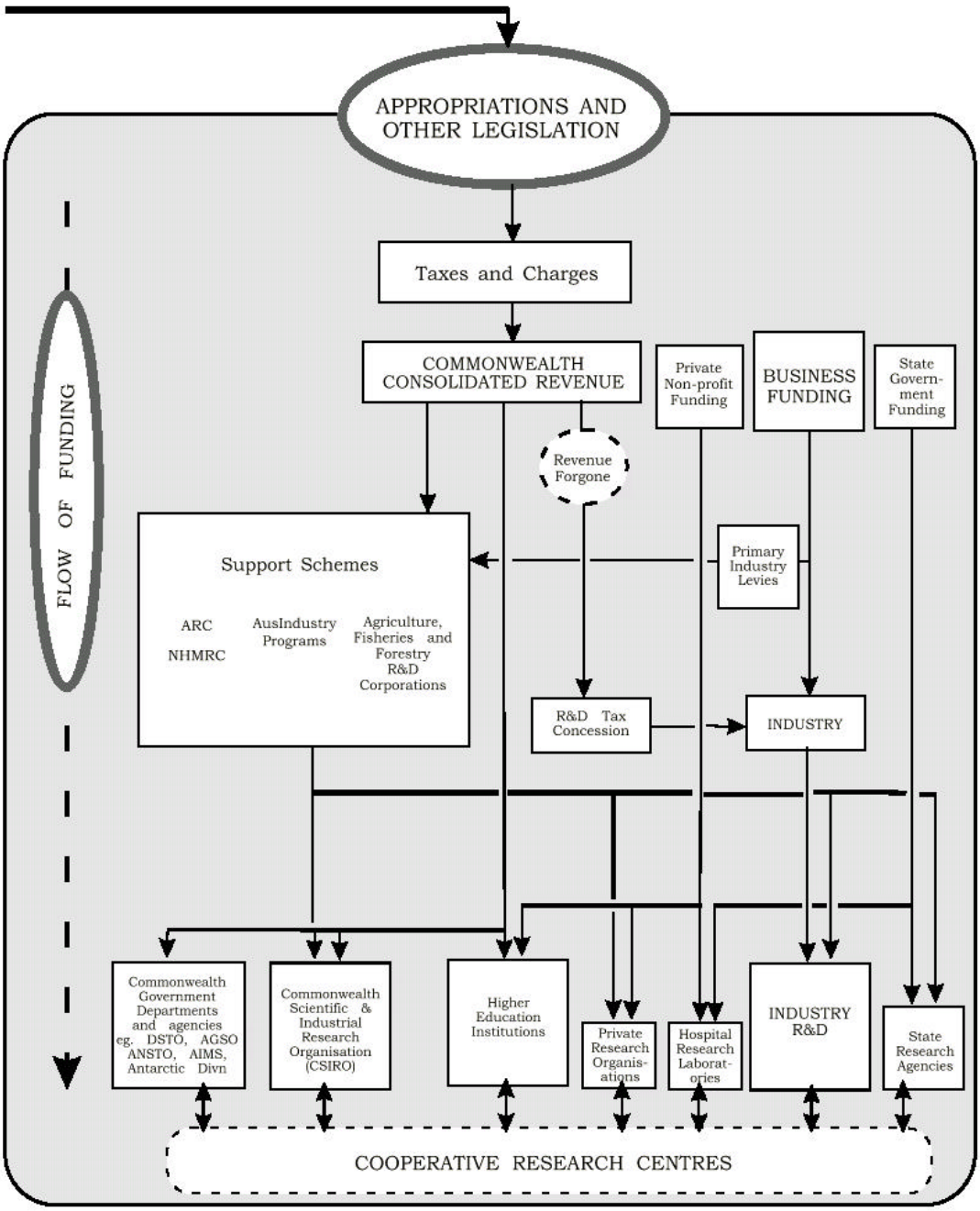
3.4.1.1 Education

Historically, education has usually been conducted in formal institutions such as schools and universities, while training has occurred in vocationally focused institutions or in the workplace. However, in recent times the distinction between education and training has been blurring, with education extending beyond the formal institutions, and training extending beyond vocational institutions and workplaces.[86] Consequently, there is significant structural change in education and training activities and new players are entering the industry.

Tertiary education in Australia is provided through universities, TAFE institutions and other Vocational Education and Training institutions. There are 41 higher education institutions in Australia to which operating grants were provided by the Commonwealth Government in 1999, and 3 national schools. There are also two private universities. In

1997, the operating revenue of these institutions amounted to $8.2 billion – 54 per cent of which came from Commonwealth Government grants. In addition to government funding, these institutions receive payments from students through the Higher Education Contribution Scheme (HECS) scheme and from other direct fee paying students – amounting to some 30 per cent of institution incomes.[87]

Figure 3.2 R&D funding support (flow of funds to R&D in Australia)



Source: ISR (1999) *Science and Technology Budget Statement, 1999-2000,* Department of Industry, Science and Resources, Canberra.

Hence, the Commonwealth Government through the Department of Education, Training and Youth Affairs (DETYA) and the operation of the Higher Education Contribution Scheme (HECS) is the major funder of tertiary education, while State governments fund primary and secondary education and are significant funders of vocational training.

3.4.1.2 Research

Of the $8.7 billion spent on R&D in Australia in 1996-97, $4.1 billion was spent by businesses, $2.3 billion by higher education institutions, $1.3 billion by the Commonwealth Government, $825 million by State governments, and $171 million by private non-profit organisations. Business funded 47 per cent of all Australian R&D, the Commonwealth Government funded 38 per cent, and State Governments funded 8 per cent.[88] About 87 per cent of the R&D performed in the Commonwealth government sector was funded by Commonwealth government organisations; about 72 per cent of State government R&D was funded by State government organisations; and about 88 per cent of higher education R&D funding in 1996-97 came from the Commonwealth Government – somewhat lower than has historically been the case.

3.4.2 Physical infrastructure

The physical infrastructure for education and research primarily consists of buildings and equipment, and the information technology infrastructure.

3.4.2.1 Buildings and equipment

Buildings and equipment form an essential part of the research and education infrastructure. In 1996-97, $250 million or 3 per cent of Australia's gross expenditure on R&D was spent on 'land and buildings' – $111 million of this was spent by the Commonwealth Government, $50 million by State governments, and $47.5 million by higher education institutions. A further $737 million or 8.5 per cent was spent on capital equipment – of which $131 million was spent by higher education institutions, $76.6 million by the Commonwealth Government, and $38 million by State governments.[89] In 1997-98, a total of $1.2 billion was spent on 'new fixed assets' for tertiary education, $894 million of which was spent by the universities.[90] Hence, buildings and equipment used for R&D in Australia cost around $1 billion a year, and those used in higher education cost a similar amount.

3.4.2.2 Information technology infrastructure

The Australian market for ICT equipment was worth around $11.4 billion in 1998, that for communications services $21 billion, and that for network services some $400 million.[91] Of course, much of this enters private use and is not attributable to the scholarly communication system.

There are no accurate data on IT expenditure in higher education. The Council of Australian University Directors of Information Technology (CAUDIT) estimate that IT

expenditure in Australian universities ranges from 2 to 20 per cent of university budgets – depending upon both use levels and data collection methods and definitions. Business expenditure on IT is generally thought to range between 4 and 10 per cent of total expenditure. If we take the higher end of business estimates to account for the relative information intensity of universities, then IT infrastructure expenditure in higher education would be of the order of $800 million per year. If we include special research organisations, such as CSIRO and DSTO, then IT infrastructure expenditure must be in excess of $1 billion per year.

3.4.3 Education and training infrastructure

The whole scholarly communication system is supported by the skills of scholars, both in Australia and worldwide. There is a range of higher education courses to produce, in part, academics and researchers in Australia, and an even wider range of more or less specialist schools, institutions and vocational education and training facilities that contribute to the development of the skills of all those engaged in the scholarly communication product system.

3.5 The regulatory framework

The regulatory framework for scholarly communication provides the context in which it operates, and is an important determinant of the incentive structures in operation, and thereby, of the structure and operation of the scholarly communication 'industry'. It includes:

- intellectual property regulation (eg. copyright, licensing, branding, etc.);
- content regulation (eg. censorship, privacy, etc.);
- telecommunications and broadcasting regulation; and
- professional regulation (eg. professional qualifications standards, regulated access to 'practice' as a professional, and professional codes of conduct).

3.5.1 Intellectual property regulation

In a sense, the whole scholarly communication product system rests on intellectual property rights in the content that forms the basis of the 'industry'.[92] However, content and related copyright is only one of the elements of intellectual property involved. Publishers create products by taking *copyright* in scholarly content, *branding* their product and *licensing* users, such as research libraries, to access that content. These three forms of intellectual property underpin scholarly publication and are all important influences on the economics of the scholarly communication product system.

The major agencies and organisation involved in scholarly IP regulation include the following.

3.5.1.1 Policy, legislation and implementation

Attorney-General's Department (AG's) has overall responsibility for copyright policy matters and advises on the government's copyright reform agenda. The Department of Communications, Information Technology and The Arts (DCITA) Intellectual Property Branch has responsibility for a range of policy issues relating to intellectual property, its management and protection. The Branch deals with intellectual property issues related to the cultural sector and the evolving information economy, and coordinates associated policy. The Department of Industry, Science and Resources (ISR) administers all other forms of intellectual property (industrial property) through IP Australia.

The Australian Copyright Council acts as a national information centre for copyright issues and seeks to assist in the effective and efficient operation of copyright in Australia.[93] IP Australia is a federal government agency which grants rights in patents, trade marks and designs. It aims to ensure that Australians benefit from the effective use of IP, particularly through increased innovation, investment and trade.[94]

3.5.1.2 Copyright collecting societies

Copyright collecting societies administer the rights of copyright holders, ensuring they are rewarded for their creativity. The societies negotiate licences with users and receive payments which they pass onto their members. Each collecting society represents a different aspect of copyright. Collecting societies have three common features. All societies collect and distribute the income earned from the exploitation of copyrights, aim to advance the economic and creative interests of the owners that they represent, and fulfil their functions by means of collective administration.[95] Ulrich's *International Periodicals Directory* lists more than 27,000 rights and permissions contact names, including collection agencies, publishers and rights agencies around the world.

Copyright Agency Limited (CAL) was set up to manage the right to copy published works by licensing. CAL administers the copying of print material by educational institutions, government, corporations, associations and others, and seeks to encourage the development of markets for published works by means of facilitating copying licenses.[96] In 1999, CAL collected $26.4 million from licensed copying, and had $20.3 million available for distribution to 5,500 copyright holders – an average of just under $3,700. CAL declared a membership of 3,947 in 1999, which suggests that 1,553 or 28 per cent of the recipients of the distribution funds were overseas copyright holders.[97] Were funds evenly distributed, this would imply that something of the order of $5.7 million was distributed to overseas copyright holders. Around half of the $26 million collected by CAL comes from education and research institutions.[98]

The Australasian Performing Right Association Limited (APRA), the Australasian Mechanical Copyright Owners' Society Limited (AMCOS), Screenrights (The Audio-Visual Copyright Society Limited), the Phonographic Performance Company of Australia Limited (PPCA), and Viscopy (The Visual Arts Copyright Collecting Agency) are the equivalent 'collection' agencies in Australia for other media.

3.5.1.3 Lending rights

A Public Lending Right (PLR) seeks to provide compensation for authors for income lost by the free multiple use of their books in public lending libraries. Whereas copyright is a proprietary right over copying, a lending right is simply a right to compensation for income lost. The PLR Committee is appointed by the Minister for Communications, Information Technology and the Arts (DCITA). It determines eligibility and approves payments under the PLR scheme. The PLR allocation in 1996-97 was $5 million – almost $4 million was paid to creators, $900,000 was paid to publishers and the remainder was used for administration.[99] An Education Lending Right committee has recently been formed, and will provide the parallel services for scholarly content and education libraries.

Of course, IP regulation is international. Australia operates within the bounds of a number of international treaties (eg. The Berne Convention). Moreover, IP regulation is driven by the major commercial content industries, including recorded music, film and computer software, with scholarly communication occupying a relatively minor, fringe position in national and international regulation.

National and international regulation of copyright, of industrial property such as brands and trademarks, and of licensing agreements, as well as the enforcement of all of these, plays an important role in creating the incentive structures that are shaping the industry in terms of industrial structures, business models, corporate and institutional strategies. We should not underestimate the influence of such regulation on the scholarly communication product system.

3.5.2 Content regulation

Of less direct significance to the scholarly communication system is content regulation. Nevertheless, it can impinge in important ways. For example, regulation of online content (such as that recently enacted in Australia) or protection of data privacy can impact on accessibility and on the evolution of incentive structures within the scholarly communication product system. And if Australia deviates from international practice on such things, it could facilitate or retard Australia's participation in the global online world.

The main agencies involved in content regulation are the Department of Communications, Information Technology and The Arts (DCITA), which is responsible for advising Government and contributing to policy on content regulation issues for radio and television services, and increasingly on online services, and the Attorney-General's Department (A-G's), which is responsible for content regulation policy relating to films, videos and *publications*. The regulatory framework for online content was introduced by the *Broadcasting Services Amendment (Online Services) Act 1999*, which commenced on 16 July 1999.[100]

While the exact implications of these regulations for online publications and delivery in internal or semi-external form have yet to be worked through, we should not

underestimate the influence of regulatory reform or overlook the consequences, both intended and otherwise, of such reform for scholarly communication.

3.5.3 Professional regulation

Regulation of professional qualification standards, regulated access to practice as a professional, and professional codes of conduct also act as important drivers and shapers – creating incentives to conduct professional activities in certain ways, and thereby act as either avenues for, or barriers to, change. Given the extent of professionalisation in academia, libraries and elsewhere in the scholarly communication product system such regulations could provide important points of leverage.

For example, although they are dealt with elsewhere in this report, professional associations and library associations are key players in the debate over the future directions for development of the scholarly communication system. In both cases their professional grounding and values are major determinants of the way they see things, their incentives and goals. Librarians fight for 'free' public access to knowledge, and the professional associations and academies fight for dissemination before profit. We should not underestimate the possibility for affecting change through professional regulation and consequent changes in professional and social values, although such an approach would likely be relatively gradual.

3.6 Scope of the scholarly communication industry

In the late 1970s, Donald King and colleagues at King Research undertook a series of studies of the scientific journal system, using a systems approach. They estimated the cost to the United States economy in terms of resources expended on the creation, production and distribution of scientific journals to be $US 4.7 billion – approximately $US 5,900 per scientist or $US 65 per article reading. This is equivalent to around $US 16.4 billion at current prices. In 1998, King et al. estimated the comparable system cost to be $US 45 billion – about $US 7,200 per scientist, or $US 60 per reading.[101] With around 120,000 science professionals in Australia, this would imply that scholarly communication in the sciences alone costs at least $1.5 billion in Australia each year.

Figure 3.3 summarises information outlined in the preceding sections on the scope and scale of activities in the Australian scholarly communication product system. It aims to give some sense of the size and importance of the scholarly communication 'industry'.

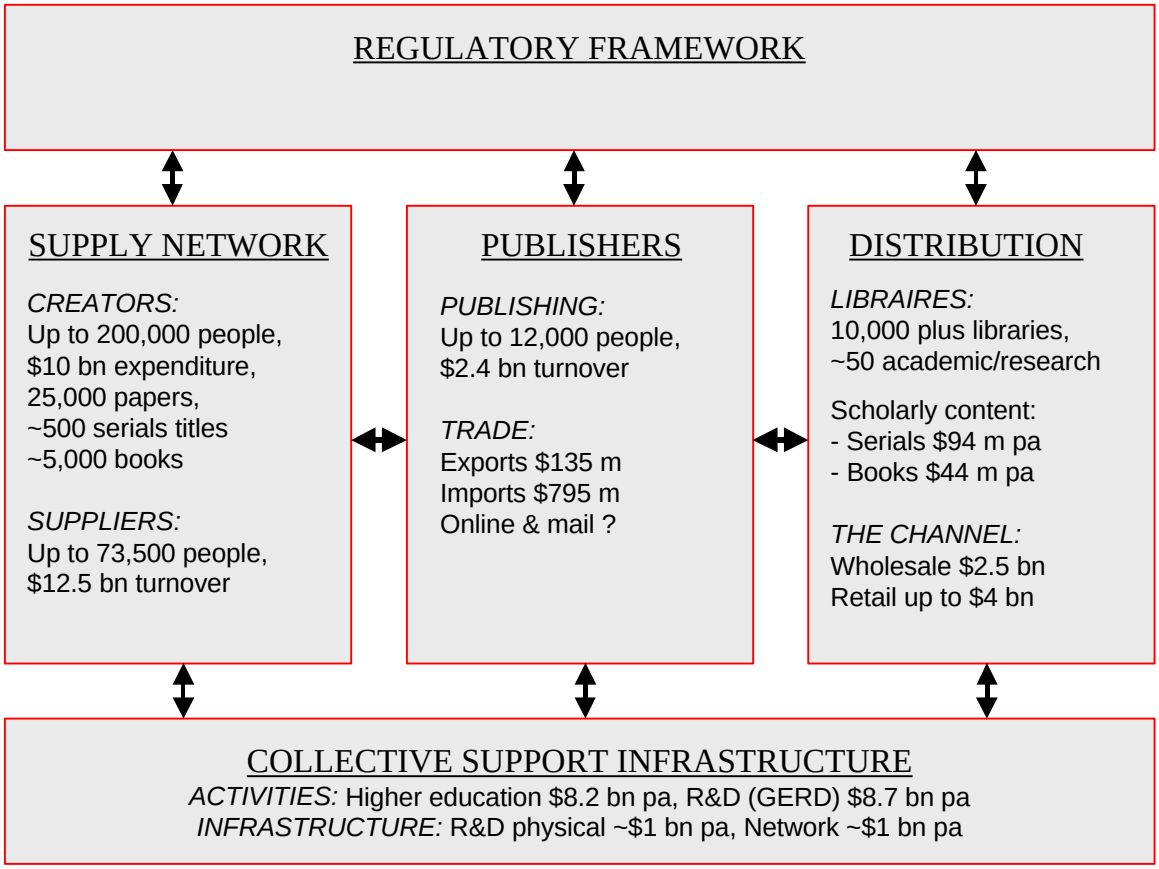
3.6.1 Creation (the supply network)

In Australian universities there are approximately 70,000 people who are potential creators of scholarly content, including academic staff and higher degree by research students. Some $5 billion a year is spent on academic activities within Australian universities. There are approximately 47,000 people are engaged in R&D activities

outside higher education, with gross expenditure on R&D (outside higher education) of around $6.4 billion per year. It is impossible to estimate the number of professionals that are potential creators of scholarly content, but given that there are some 900,000 possible candidates in the professions it is reasonable to assume that at least 100,000 are potential content creators. In 1994, authors in Australian higher education alone published 3,500 books, almost 5,000 book chapters, 23,650 journal articles, 653 review articles and more than 10,000 published conference papers.[102]

Hence scholarly content creation involves up to 200,000 Australians, whose activities are supported by annual expenditures well in excess of $10 billion, in the publication of some 25,000 academic papers, and perhaps as many as 5,000 books each year.

Figure 3.3 Approximate scale of activities in the scholarly communication product system in Australia



Source: Compiled from various sources (CSES analysis).

Paper and paper product manufacturing in Australia employs some 17,000 people realising a turnover of $5.2 billion per annum. Paper stationery manufacturing employs a further 8,500 and realises turnover of $1.2 billion. Printing employs 40,500 and realises turnover of $5.4 billion, while specialist services to printing employs 7,460 people and realises a turnover of $700 million. While much of this is not directly related

to scholarly communication, even a relatively small proportion of the total 73,500 jobs and $12.5 billion turnover represents significant activity in the Australian economy.

3.6.2 Production (publication)

Publishing in Australia employs a total of more than 41,000 people, and publishing businesses generate turnover in excess of $7 billion per year. Periodical publishing, excluding newspapers, employs some 6,750 people in Australia and realises turnover of $1.1 billion. Book publishing employs a further 5,400 and realises $1.3 billion. There are in excess of 250 private book printing/publishing businesses in Australia, excluding university presses and associations. Hence publishing activities, excluding newspapers, employ more than 12,000 people and realise turnover of around $2.4 billion per year.

Trade in publications and printed matter is also significant. During calendar year 1999 Australia exported printed publications worth $135 million and imported no less that $795 million. This does not include individual orders sent by mail or online electronic publishing or purchasing.

3.6.3 Distribution (channel and clients)

There are approximately 40 university libraries, 10 or more specialist R&D institution libraries, more than 550 public libraries and around 9,600 school libraries operating in Australia. University libraries spent $94 million on serials subscriptions last year, $44 million on books and other scholarly content, and a further $12 to $15 million for copying. Other specialist public and private sector libraries may well have spent as much again.

Paper and paper product wholesale sales in Australia are in excess of $1.5 billion per year. Book and magazine wholesalers employ around 6,000 people and realise a turnover of more than $1 billion a year. Retail sales of newspapers, books and magazines are of the order of $4 billion per year.

3.6.4 Collective support infrastructure

Some $30 billion is spent on education in Australia each year, of which more than $8.2 billion is spent on higher education. Gross expenditure on R&D is now around $8.7 billion per year.

At least $1 billion per year is spent in Australia on physical infrastructure in higher education and R&D activities, and a further $1 billion plus is spent on the information technology infrastructure.

Clearly, the scholarly communication product system involves a wide range of activities that are important to the Australian economy; both in terms of their sheer size –

reflected in numbers of jobs and financial resources involved – and in terms of the importance of the scholarly communication system as an infrastructure for the emerging knowledge economy – an infrastructure which plays a key role in the communication and dissemination of ideas.

4 Economics of Scholarly Communication

In this chapter we explore some of the economic issues involved in the creation, production and distribution of scholarly content. Each section looks at the incentive structure, how it shapes what is happening, some of the issues involved and some of the economic arguments that are discussed in the literature with a view to suggesting which directions might be most fruitfully studied in more detail. But first we take a brief look at the economics of knowledge and information.

4.1 Economics of knowledge and information

In section 1 we looked at some of the reasons why the economics of the knowledge-based economy might be different from traditional economics which developed to describe the resource-based economy of the 19th century. In that section we briefly explored some of the characteristics of knowledge and information and drew out implications for the operation of the knowledge-based economy and for information-based businesses in it. We will not cover that ground again. Nevertheless, some remarks about the nature of knowledge and of value in the scholarly communication system are in order.

4.1.1 The nature of knowledge

It is common to draw a distinction between tacit and codified knowledge. *Codified knowledge* consists of information or ideas that can be written down and transmitted. *Tacit knowledge* consists of ideas and understandings that are more difficult to acquire and transmit – it resists codification, and remains inherently human. This simple distinction can be used to tease out a key difference between knowledge and information.

Knowledge (tacit knowledge) is something that is held by people, it is developed through education and learning. *Information* (codified knowledge) is knowledge that has been ordered and written down, and it can be transferred in that form. In the act of ordering and writing down, a product that can be used by others is created. Information can be seen as the product of the act of codification of knowledge.

Information is produced by individuals in the course of earning a living, and by organisations in the course of earning a profit or justifying continued public funding support. There is a cost of production, and (intellectual) property rights exist to give those who create information the opportunity to recoup those costs and thereby an incentive to produce in the first place. So, while it can reasonably be argued that knowledge is a (pure) 'public good', typically, information is not.

Nevertheless, information is, basically, non-rivalrous in consumption. If one person consumes a cheese sandwich, it is gone: no one else can consume it too. If, however, one person reads a journal article and gains knowledge from it, the information in the article and the potential for someone else to also gain knowledge from it remains. It is not the standard economic situation in which scarce resources are allocated in a zero-sum game. Rather, for a fixed cost of producing a journal article the potential social return is limited only by access. The benefit can be realised again and again. Hence, social return on investment in its generation can be multiplied through its diffusion.

Box 4.1 Knowledge takes different forms

Knowledge takes different forms – and it is particularly important to distinguish between explicit and implicit forms. Explicit knowledge (*codified knowledg*e) ranges from very basic information with very little explanation or detail, such as data on the heights and weights of the population, or a telephone book or catalogue, to much more complex forms of information, such as technical manuals, text books, or academic papers. But any form of explicit knowledge requires at least some degree of implicit knowledge (*tacit knowledg*e) if it is to be absorbed, understood, and used effectively. At one end of the information spectrum even a sign post requires a person to know the meaning of an arrow shape. At the other end, it will commonly take the highly developed design skills of an industrial engineer to put an innovative idea into effective practice —no matter how explicitly it may be described. Similarly, implicitly possessed creative skills are required for the effective implementation of good ideas for new and improved services.

ISR (1999) *Science and Technology Budget Statement 1999-2000*, Department of Industry, Science and Resources, Canberra, p1.4.

This 'scarcity defying expansiveness of knowledge' is the root of one of its most important defining features. Once knowledge is discovered and made public, there is essentially zero marginal cost to adding more users.[103]

> "Because knowledge does not wear out and people can duplicate it practically without cost, it is a source of supervalue and superproductivity. Knowledge alone can add value to an otherwise closed, zero-sum system of value. It can increase value without diminishing it somewhere else..."[104]

> "Ideas and information exhibit very different characteristics from the goods and services of the industrial economy. …the social value of ideas and information increases to the degree they can be shared with and used by others… The more such items are (re)produced, the greater the social return on investment."[105]

Social returns on investment in information are maximised through expansion of access and wide dissemination, not by limiting access and exclusion.

4.1.2 Value in the scholarly communication product system

Before looking in more detail at the economics of creation, production and distribution in the scholarly communication product system it is worth taking a brief look at what the product is, and where the value lies.

From the perspective of scholarship, an essential element of the scholarly communication system is that it be based on merit rather than means. That is to say that peer review and selection on the basis of merit form an essential part of the process. From the publishing perspective, this merit principle has a different value. It is the basis of quality control.

Many assume that the product of the scholarly communication system is content. In one sense, of course, it is. But that is not the whole story. Information is an 'experience good'. As such it cannot be judged easily. Until you have bought and consumed the information you do not know its value, and once you have it is too late to decide not to buy it. The decision to buy is not made on the basis of the content, directly, but on the basis of other value cues.

A researcher new to a field might make extensive use of abstracting and key word searching to identify articles to read. More experienced researchers might use other signals, such as the institutional affiliation of the author(s), who the authors are, the title of the journal (including knowing of the work of the editor and editorial board), and/or the publisher and publishing stable. Because the decision to buy and consume is made in these ways, these things become important determinants of value – they are the information making the sale, not the content. Content may be king, but selection, quality control and subsequent branding are major determinants of value.

4.2 Economics of creation (authoring)

In this section we look briefly at some of the issues in the economics of content creation, focusing on the incentives faced by creators and on some of the alternatives to the present system suggested in the literature.

4.2.1 Incentives for creators

The creators of scholarly content (authors and editors) face a range of incentives that encourage that creation under the current system. It is worth briefly reviewing this incentive structure.

Creators may seek to publish the results of their work in order to contribute to their area of scholarship and open their findings to peer review, or in order to lay claim to particular discoveries or developments. In some disciplines this means publishing a book, in others it means publishing in a journal or lodging a patent application. They may seek to establish the quality of their work by publishing through a prestigious publishing house or in a journal that is widely recognised for its quality and rigorous

review process; or they may seek to establish themselves and a group of colleagues as the leaders of a particular emerging field by starting a new specialist journal.[106]

In addition to these professional, scholarly incentives there are a number of institutionalised incentives. These include employment. Scholars' and professionals' (especially those in public institutions) publication is part of the job: getting and keeping such a job may depend upon publication. Promotion, tenure, and increased salary often follow as publication is seen as an important indicator of performance. Greater weight is attached to refereed publications by most institutions.

Usually of less significance, and by no means common are direct payments from the publishers of the work. Writing and reviewing journal articles rarely attracts payment, and editors are rarely paid more than partial cost recovery – usually in the form of an honorarium. Even more rarely is writing an academic monograph an effective means of getting rich, although royalty payments are made to authors.

Editors, members of editorial boards and contributors usually receive copies of the journal free, as well as off-prints of their own papers. More importantly the journal gives access to a network of scholars in the field for which the editor forms a focal point, and members of the editorial board, regular reviewers, contributors and readers orbit. Such networks of scholarship can be extremely important. To a lesser extent, the same can true of publishers, especially the smaller more specialised book publishers that maintain active contacts with their network of authors (eg. Edward Elgar).

In a survey of 'What Authors Really Want' Swan found that:

- Communication with peers remains the main motivation for publishing, enhancing career prospects, gaining prestige and funding were the other reasons cited;
- For authors in the sciences future funding was a more important motivator than it was for authors in the arts and humanities;
- Reputation of the journal is the primary consideration in deciding where to publish, followed by impact (international coverage, coverage by abstracting and indexing services, etc.), circulation, subject coverage and publication speed are also considered;
- Scientists are much more concerned about availability in electronic form than are those in the arts; and
- Reproduction quality also matters more to scientists.[107]

The key features of these incentives for creators are that few add very much to the cost of content to publishers, and they distort the system. Scholarly communication and widespread dissemination of scholarship, on the one hand; and publishing in a few key refereed journals for the purposes of promotion and tenure, on the other, are different and increasingly divergent, if not conflicting, goals.

4.2.2 Creation: Issues and discussion

What follows is a brief review of some of the issues discussed in the literature. The aim is to provide a general economic critique and thereby highlight issues worthy of further study, and to shed light on the operation of the scholarly communication product system.

4.2.2.1 Authors on the demand side

Some argue that: "authors are not simply content originators; they drive the information explosion by seeking the most prestigious outlets for their increasing quantities of journal articles… Both authors and editors then apply pressure to ensure that their institutional libraries hold the journals to which they are affiliated either as authors or editors. Thus, academics as authors and editors effectively represent demand in this market."[108] This has led some to put authors on the demand side and, in turn, to suggestions that journal subscription prices could be reduced if authors paid to have their work published.

Harnad has been one champion of the idea of levying a charge on authors as a payment for the widespread distribution of their work, and has suggested modest per page charges of "dozens rather than hundreds of dollars per page."[109] Harnad suggests recovering all costs through author submission fees. Other variations suggest payments for papers published, or for papers submitted regardless of whether or not they are actually published, and various mixes of cost recovery through submission *and* subscription fees.[110] There are a number of issues arising from such approaches.

Firstly, the public goal in a knowledge-based economy must be to encourage and facilitate the dissemination of information. Clearly, any disincentive to publish goes against this aim. It is also a fundamental principle of the scholarly publication system that publication should be on the basis of merit alone. Introducing an author payment system introduces the possibility that younger, less established scholars will be disadvantaged relative to those from prestigious institutions who can afford to pay for publication. Any move away from a merit-based system towards even the most selective form of vanity publishing should be treated with caution.

Secondly, the money payments involved would incur considerable transaction costs. The process might involve individual authors or their employing institutions – who derive status from the publications – raising cheques, commonly in a foreign currency; and publishers collecting, recording, accounting, etc. for all the thousands of relatively small payments. Notwithstanding the growth of collection agencies and systems for micro payments, it is likely that the transaction costs involved would reduce the potential cost savings, and may prove prohibitive.

Thirdly, the implicit assumption that reduced costs of creation and production would be passed on by publishers in the form of reduced prices to distributors and consumers is dubious except where the model involves alternative publishing mechanisms. *If* major serials publishers wield monopoly power, and the work of McCabe and others suggests

that some may,[111] then a reduction in serials prices would be unlikely to automatically follow a reduction in costs.

Fourthly, there are very different patterns to serials publication in the arts and humanities on the one hand, and the natural sciences on the other. It is typical for the majority of papers submitted to science journals to be published, whereas only a minority of those submitted to humanities journals are published. This obviously raises issues of fairness and equity across fields of scholarship. More specifically, where the model relies on payment for publication, the publishers of a humanities journal would confront an economic incentive to accept a higher proportion of papers for publication than under the current system. It would, for example, be possible to increase revenue to cover rising costs or increase profit by lowering the bar of scholarship. Moving from the current situation where revenue can be increased through increased circulation and wider dissemination and/or increased prices, to one where revenue can be increased by lowering the standard of scholarship is an unattractive proposition.

Finally, it has been suggested that to recover costs using Harnad's model submission fees would have to be significantly higher than Harnad proposes. Halliday and Oppenheim put cost recovery under the Harnad model at anything between £97.66 and £878.90 per article depending on the rejection rate (whether the journal is in the natural sciences or humanities). The New Journal of Physics, which currently operates on the Harnad model, charges $US 500 per published paper – a rate that Halliday and Oppenheim suggest does not fully cover costs.[112] Such levels of author payment are likely to be a disincentive, and could lead to a reduction in publication and dissemination – the antithesis of the underlying aim of the scholarly communication system.

4.2.2.2 Authors on the supply side

Making payments *to* authors, editors and reviewers in exchange for their work and intellectual property appears to be a somewhat fairer system. After all, their work is funded by education and research grants and/or by private investors, so why should multinational publishing companies get the content derived from it for free?

Given the eagerness of many scholars to publish, and the existing institutionalised incentive system which rewards them for doing so, it is unlikely that publishers would be willing to, or required to, pay very much. Small payments raise the same transaction cost problems noted above – the cost of small payments is relatively high. Publishers would have to raise thousands of small cheques, in hundreds of different foreign currencies with all the administrative costs that would entail. Individual scholars and/or their employing institutions would face considerable transaction costs in tracking payments, banking, them etc. And individuals would agonise about how to treat such payments in their income tax returns, and may require advice from tax accountants. All in all, the transaction costs involved would appear to be substantial, perhaps prohibitive.

Then there would be questions as to the rightful recipients; authors, their employing institutions, or the many public and private funders of the work. These questions could

prove highly controversial and disruptive, with some funders insisting on their rights to payments, some institutions using payments to attract staff, some senior staff able to negotiate individual arrangements that junior staff cannot, etc. etc. Moreover, the economic incentives may work against the underlying principles of scholarship. Institutions that could afford to pass payments to authors and editors, could attract more senior staff and thereby increased funding support; whereas those that could not afford to pass on the payments would tend to lose staff and funding support. Individuals might also be polarised into the haves and have-nots, with junior staff unable to keep the payments which might support their work. The danger is that the incentives introduced by such a payments system might tend to undermine the ideals of scholarship.

And, of course, payments by publishers to authors would simply raise inputs costs for the publishers, which *if* they are operating in a competitive market on low margins they will be obliged to pass on to their customers in higher subscription prices, and *if* they wield monopoly power they can pass on at will, regardless of the margins they enjoy, having a perfectly logical and reasonable argument for doing so.

In their modelling of a system involving author and editor payment, royalties and subscription Halliday and Oppenheim suggest that such a system does not compare well with the traditional or alternative models for journal production, being relatively expensive due to the internalisation of creation costs.[113] This, even though they largely ignore transaction costs.

Perhaps these difficulties suggest that rewarding institutions that provide a significant amount of material and/or editorial support with discounts on subscriptions, as is at least implicitly practiced by some publishers, offers an immediately practical means to give some 'credit' for the work done in content creation with institutional support. How this might affect incentives and the distribution of rewards is not yet clear. It might, for example, significantly favour larger more specialised institutions (eg. CSIRO) over smaller generalist institutions (eg. any of the smaller universities). How it could be integrated with consortial purchasing is also unclear.

4.2.2.3 Creation/creator costs

While there is little discussion of the costs of authoring, there is discussion of the costs involved in editorial activities – even though those activities are largely unpaid. In their analysis of content origination costs, Halliday and Oppenheim model the external editorial and refereeing costs at 30 minutes for the editor and a total of 6 hours for refereeing (2 referees for 3 hrs each) per paper. At an hourly rate of £50 to cover salary and on-costs this suggests external editorial and refereeing (selection) costs of £325 per paper.[114] These costs are typically borne by the employing institutions.

The preparation of papers by authors is very difficult to cost. At one extreme, the entire cost of the education and experience that enables an author to write could be attributed to the paper or book written. At the other extreme, the paper or book could be seen as a necessary part or by-product of the activity of scholarship, with no attributable cost of its own. More realistically, perhaps, the directly attributable cost of actual writing could

be consider the cost of authoring/creation. While this cost would vary greatly between authors, fields of scholarship and individual circumstances, perhaps it is not unreasonable to assume that an author might take a week to prepare a paper for publication (excluding the research that is behind it) and up to 10 weeks to prepare a book for publication. With this as a guide, current senior academic pay rates would imply directly attributable authoring costs of the order of $2,000 to $4,000 for a paper, and $20,000 to $40,000 for a book.

4.2.2.4 Non-cooperation

There are proposals that suggest various forms of non-cooperation, including restrictions in handing over intellectual property rights, and withholding editorial services.

4.2.2.4.1 Retaining intellectual property (IP)

There is a perception that universities and research institutions are paying dearly for access to content that was created by their own employees at their own institutional expense.[115] To many this seems unfair. Why should we be buying back from international commercial publishers what we gave them for free?

Various approaches have been suggested to redress the balance. Some institutions on their own behalf, or on behalf of their employees, seek to retain IP; giving publishers non-exclusive rights and changing the balance of power in purchasing institution-publisher relations. In Australia, the CSIRO has recently taken just such a course.

However, it is not clear where exercising rights over your share of content production leads. If Australians produce 2.5 per cent of the world's scientific papers should we be negotiating a 'national site license' with a 2.5 per cent discount? If everyone used such a formula, the United States would get such a large discount that its research and education input costs would be significantly lower, and students and research funding would tend move to the United States – the low cost producer. From an Australian point of view it is hard to imagine how such a scenario could help, except of course in the highly negative way of killing demand for scholarly publications in Australia.

There is a broader issue in copyright and other IP in university and research institutions relating to the incentives to produce/invent, innovate and commercialise. There is a common perception in Australia that we are poor at commercialising our research. Much of the reason for this rests with industry, which for a range of structural and cultural reasons is often relatively slow to seize upon new ideas and take up new methods. However, there are also barriers on the supply-side. Institutional arrangements relating to IP in Australian universities are many and varied, but there is a general tendency for IP to rest with the employer in the absence of specific agreements to the contrary. But unless individual researchers have a direct economic interest in commercialisation of their work they are unlikely to push as hard for it. Getting the incentives for scholarship *and* commercialisation right is a difficult but important goal.

Box 4.2 Journal editors switch publishers on account of price increases

In an unusual step, the entire Editorial Board of the Journal of Logic Programming (JLP) left Elsevier Publishers, founded a new journal, Theory and Practice of Logic Programming (TPLP), to be published by Cambridge University Press. As did JLP, TPLP expects to publish about 1,000 pages per year. The price to libraries of the new journal will be about 55 percent less than the price of JLP. This was the reason for the move.

Professor Maurice Bruynooghe, the editor-in-chief of the JLP for the past eight years, explained that in the period from the journal inception in 1984 until 1999 its price per page increased by the staggering amount of 314%. This occurred in spite of the fact that the volume of the journal substantially increased and the fact that currently almost all of the typesetting work is done by the authors themselves.

Because of these price increases, the then editors of the JLP started discussions in June 1998 with Elsevier with the intent of reducing the cost of the journal to libraries. After prolonged, but unsuccessful, negotiations with Elsevier, the entire editorial board of 50 scientists resigned at the end of November 1999 and moved to form a new journal, ``Theory and Practice of Logic Programming,'' to be published by Cambridge University Press starting in January 2001. Professor Bruynooghe, submitted his resignation effective the end of December, 1999. Professor Emeritus John Alan Robinson, of Syracuse University, and Founding Editor-in-Chief of the JLP, asked Elsevier to remove his name as Founding Editor-in-Chief of the JLP. The Association for Logic Programming (ALP), the only organization representing the interests of the logic programming community worldwide, endorsed the new journal and withdrew its support from the JLP.

In the middle of March, 2000, Professor Krzysztof Apt, President of the ALP, placed an announcement on numerous internet newsletters explaining the formation of the TPLP and requested that libraries and individuals now support the TPLP. Apt reports that he has received several congratulatory email messages from a number of prestigious libraries. Apt also clarified that Professor Emeritus Jack Minker of the University of Maryland was asked by the editors to become the Founding-Editor-in-Chief of the TPLP. Professor Minker agreed, with the understanding that shortly after the first issue of the TPLP appears, he resigns in the expectation that Professor Bruynooghe would then become Editor-in-Chief of the TPLP. Although Bruynooghe and the area editors resigned from the JLP in 1999, they are cooperating with Elsevier to oversee the publication of the backlog of the JLP papers in the year 2000.

Professor Minker stated, "The final decision to move to the CUP was taken unanimously by all area editors and editorial board members. Editorial Boards of other scientific journals should review their library subscription prices as did the editors of the JLP."

The editorial board of the Theory and Practice of Logic Programming includes several prominent computer scientists, all of whom resigned from the editorial board of the JLP. Among the members of the editorial board are a Turing Award winner and member of the U.S. National Academy of Sciences, a member of the U.S. National Academy of Engineering, and the creators of the field of logic programming. They are:

Alain Colmerauer (University of Marseille), the creator of Prolog, the most known logic programming language.

Robert Kowalski (Imperial College, London), the creator of the logic programming paradigm.

John McCarthy (Stanford), one of the founders of the field of artificial intelligence and winner of the Association for Computing Machinery's Turing award, the most prestigious award given to computer scientists for their research. He is also the winner of the prestigious Kyoto Prize given to outstanding scientists, the US National Medal of Science, and a member of the United States National Academy of Sciences.

Jeff Ullman (Stanford), a member of the United States National Academy of Engineering and, according to the Web Citation Index (http://citeseer.nj.nec.com/cs) the most cited computer scientist in the world.

Source: Press Release issued on April 7th 2000. For further information contact: Jack Minker, Professor Emeritus, Department of Computer Science Institute for Advanced Computer Studies University of Maryland College Park, Maryland 20742. e-mail: minker@cs.umd.edu or Professor Krzysztof, R. Apt CWI Kruislaan 413 1098 SJ Amsterdam The Netherlands. email: k.r.apt@cwi.nl

4.2.2.4.2 Withdrawing services

Some suggest that academics and researchers should withdraw their editorial services from publishers that are charging high prices and seek to develop alternative titles as a way of forcing some of the larger commercial publishers into more reasonable pricing strategies. However, given the existing incentive structure facing academics and researchers it is unlikely that many would do so. Without significant reform of the institutional arrangements operating within the present system, it is simply not in their interest.[116]

Moreover, there is little to stop commercial publishers taking over the more successful of the new and emerging independent titles as they grow, thus simply restarting the cycle. And in the meantime, starting alternative titles merely aggravates the problem – multiplying the number of titles to purchase and pushing up aggregate fixed costs.

4.2.3 Alternative publishing models

One of the major avenues for change suggested in the literature is a range of alternative paths for publication which bypass existing mechanisms and existing commercial publishers. These include do-it-yourself and various forms of electronic publication.

4.2.3.1 DIY publishing

Some analysts have suggested that the advent of more or less ubiquitous information and communication technology among education and research scholars provides an opportunity for them to bypass the major commercial publishers and publish at much lower cost – breaking free of what Harnad has called the 'Faustian Bargain'.[117] A number of organisations, such as SPARC (Scholarly Publishing and Academic Resources Coalition) in the United States, offer support and encouragement for self-publishing initiatives.[118] While it is no doubt true that the IT revolution does provide such an opportunity, and one that will become more accessible as the technology evolves, that opportunity is by no means costless.

Some argue that scholarly communication is unusual in that the producers are also the consumers, and that there are major opportunities for disintermediation. First, it is worth noting that being both producers and consumers is *not* unusual. Indeed, it is common in many parts of the economy. Whenever one cooks a meal or mows the lawn one is both producing a service and consuming it. Major businesses depend on 'prosumers'. Among the major examples are DIY superstores, which are oriented specifically to the home renovator who is both producing and consuming construction services. And it is important to note that rapid increases in house prices or car prices lead few people to conclude that they should build their own house or their own car. There are good reasons for this. There are efficiency gains from specialisation, such that concentrating on producing what we are best at producing and trading with others for things they are better at producing leads to greater net welfare.

The two basic explanations for the borders of firms being where they are, essentially determined by a 'make versus buy' decision, depend upon transaction costs and competencies.[119] Put simply, we do not typically build our own cars or houses because we can't – we lack the skills and the supply networks necessary to do so, and the training, equipment inputs and time involved in overcoming these problems would be prohibitively expensive compared to buying a car or house from a specialist organisation with the necessary skills and market knowledge.

Self-publishing suggests that additional activities, many of which are currently performed by publishers, would have to be performed by the researchers and academics themselves or by others employed by their institutions. But there is no reason to suppose that the creators of scholarly content (authors) would make good/better publishers, and some evidence to suggest that there may be net gains to be derived from them concentrating on the creation of content and their institutions on education and/or research, and leaving publishing to publishers.[120] Indeed, it is far from clear that individual academic time or institutional resources – including potential loss of focus on core business – would be best spent in the *production* process of publishing, with consequent diversion of time and resources from the process of *creation.*

Moreover, in some areas it is simply not true that authors are both producers and consumers. Authors and readers in an area like particle physics do form a more or less closed group, but in medical, legal and engineering fields authors and readers are typically not the same – authors being drawn from researchers and readers from practitioners.

4.2.3.2 Electronic publishing

Clearly electronic publishing affords a major dimension for innovation in scholarly communication. Indeed, it has already revolutionised it. But in the context of the economics of publication, some important doubts remain.

First, there is the very considerable capital and recurrent cost of the information and communication technology (ICT) infrastructure necessary to make it work. Few of the models for electronic publication put forward in the literature take full account of the ICT infrastructure costs involved, preferring to assume ubiquitous access. Too often the costs involved in electronic publishing are merely shifted from the producer to the user, be it in the form of ICT infrastructure costs or simply printing costs for monographs that are unsuitable for online reading.

Second, it is far from clear that the cost of electronic publishing is significantly lower than print publishing. Some argue that electronic publishing in much cheaper than print.[121] However, the evidence outlined below relating to the costs involved in print journal publishing suggests that: unless the whole process is geared to purely electronic publication cost savings may be relatively modest, dual mode publication increases costs, and new opportunities for value adding features in electronic form makes cost comparisons difficult – the print and electronic products are different products and exhibit different values in use.[122] (See 'Journal Production Costs' below).

Electronic publishing is bringing new opportunities for innovation in terms of both the institutional and cost structures of the scholarly communication industry. What is less clear is who the most economically efficient electronic publishers may turn out to be – the scholars themselves, scholarly and professional associations, employing universities and research institutions, the commercial publishers that dominate the print media, or new players entering the frame (such as the ICT services or equipment companies that provide the information 'highway') or new forms of public or private consortia built from combinations of these groups.

4.2.3.3 Pre-print servers & internet

Alternative mechanism for dissemination that are often discussed include the use of pre-print servers and simple, direct internet publication.

4.2.3.3.1 Pre-print servers

Although quality control features in these options to varying degrees it remains a critical issue. As more and more information becomes available reliable filtering is increasingly valuable. There is increasing need for the consumer of scholarly content to know what to read – or more importantly, what not to read. The opportunity cost of consuming scholarly content is high. One of the great strengths of the current system of scholarly communication for both authors and consumers is the filtering process involving reliable, consistent, open and trusted *peer review and selection*. It has been reported that physicists reading material from the Ginsparg archive tend to read only articles by authors whose work they know,[123] suggesting that they apply substitute filtering strategies which may have some negative consequences on scholarship – eg. making it harder for new authors to gain recognition, and increasing the chances of missing important developments.

Launching papers onto pre-print servers at a relatively early stage of the selection process will tend to undermine the value of selection.[124] In the natural sciences, where the majority of papers submitted are published the selection out of the remainder is of limited, or at least marginal value. In the humanities, however, where the majority of papers submitted are rejected, the selection is much more important. This would suggest that while pre-print servers of this type may work in the natural sciences (eg. Ginsparg's Physics Archive), they are much less likely to be successful in the humanities.

Taking a finer-grained view, it may well be that there are significant differences between the disciplines *within* the natural and other sciences. Work tracing industries to their 'science base' and discussion of the nature of industrial innovation suggests that some sciences are fundamentally theoretical while others are fundamentally experimental, and that the theoretical sciences are typically pursued in public sector institutions while experimental science that has been commercialised tends to be pursued in private sector organisations. For example, theoretical physics is typically pursued in universities and other public sector institutions, whereas the leading edge of semiconductor electronics is often to be found in private companies (eg. IBM, Intel, Nokia, NEC, etc.). The organisation of these activities implies very different

dissemination behaviours likely to require very different publication strategies (eg. widespread distribution of pre-prints in physics a la Ginsparg, versus much more guarded circulation of results in electronics – with most people carrying a briefcase full of confidentiality agreement forms rather than pre-prints to conferences).

Other, cross-cutting dimensions include the extent to which the authors and readers overlap, and the pure and applied dichotomy. Where there is a strong overlap between authors and readers (eg. theoretical physics) critical appraisal is effectively built into the reading. Where there is much wider readership than authorship, and potential application of findings (eg. medical science and engineering), there tends to be less critical appraisal in the reading and greater need for external expert review. There may also be public welfare considerations. There are already concerns about the potential for health information on internet to mislead. John Cox sites the example of a pre-refereed paper on the potential side-effects of MMR (measles, mumps and rubella) vaccine leading to reports in the popular press, and eventually to a 30 per cent drop in infant vaccination and a consequent re-emergence of rubella in the United Kingdom.[125]

4.2.3.3.2 Internet publication

Direct to internet publication suffers even more from a lack of faith in the selection process. This is not to say that there cannot be successful, high quality internet publications, rather that it is likely to take somewhat longer than many people think to build up the trust in freely or very cheaply available content over internet unless it is clearly associated with an existing reputable source, such as government departments, university and other institutional or commercial publishers. A difficulty with the internet is that high quality material is 'guilty by association' with a lot of lower quality material.

In both pre-print server or direct to internet proposals the issue of the very considerable capital and recurrent costs involved in access to, and use of, information and communication technology infrastructure remains. To get a true picture, an attributable proportion of these costs should be factored into the scholarly communication product system – not assumed away, or conveniently ignored.

4.2.4 Scholarly communication and grey literature

The variety of self-publishing and internet publishing available to individuals and organisations is leading to an enormous growth in grey literature. Odlyzko suggests that scholarly communication has been revolutionised by IT, but scholarly publishing in its traditional form is lagging.[126] The attractions of bypassing a slow publishing process and ease of communication with peers are obvious. Less obvious are the longer term costs. The distinctions between scholarly communication, publication and dissemination are important.

Firstly, there are not yet any standards or organisational responsibility for collecting and preserving web-based publications, data collections, or discussions. For researchers involved in the network and concerned mainly with the current leading edge of work

this is not a problem. But wider dissemination is more difficult. We have already noted that the knowledge distribution power of the national innovation system is as, if not more, important that its knowledge production power.[127] So the dangers of creating a barrier between those producing and those consuming information should not be underestimated. The ability of those starting out on a career of research, of educators and of researchers expanding their reach into new fields, as outsiders to the core scientific network, to trace the thread of development will be compromised without the collection, cataloguing and preservation activities that in the print era have been the role of libraries. In effect, advances in scholarly communication (in group) are producing difficulties for dissemination (out of group).

Secondly, evidence suggests that researchers do in fact refer back to papers produced 20 years ago – perhaps to re-trace a thread of development in an attempt to discover where a wrong turn had been made and a blind alley chosen. It is not yet clear how this could be done in 20 years time, because no one is, as yet, archiving internet. More immediately, there is no easy bridge between the print and electronic world, which as yet exist in a separate space without common search and access.

Thirdly, there are no standards for versioning online documents. Anecdotal evidence suggests that there have been occasions when reports published on internet have been changed after publication without any notice of those changes. Stories of government reports being changed to avoid embarrassment circulate widely. Obviously, whether these stories are true or not, there is the potential for history to be re-written whenever publications exist only on internet and are not registered, deposited in the national and/or state library and preserved as originally received.

It is still early days in the development of internet, and perhaps not surprising that the enormous attraction of its potential to facilitate immediate, low cost communication overshadows the many potential difficulties that its very advantages create. Nevertheless, there are significant issues to be worked through, and significant costs involved in doing so.

4.3 Economics of production (publishing)

We begin this section with a brief look at the incentive structure faced by publishers, before looking at the costs involved in the process of production, and examining the economics of publishing and some of the business models that publishers adopt.

4.3.1 Incentives in the production of scholarly content

Content producers (publishers) face a range of incentives which derive from the nature of their product and their market. In the following sections we explore some of these, focusing on scholarly journal publication.

4.3.1.1 Concentration and competition

Books and journals are typical information content products in that 'first copy costs' are high while the marginal cost of (re)production is low – often virtually zero when in digital form. Such products are subject to increasing returns, rather than the decreasing returns characteristic in resource-based economies or the constant returns assumed in the neoclassical paradigm.

Traditional economics argued that as production expands producers are driven to use ever more marginal inputs. In so doing they face rising costs and, thereby, diminishing returns. In the agricultural world of the nineteenth century diminishing returns made sense. But in a knowledge-based economy increasing returns – declining average costs in production – due to scale, learning economies and/or near zero marginal or copy costs are common.

Arthur cites high up-front or first copy costs, and network effects – the more people use it the more valuable it is (for authors, publishers and readers) – as two key reasons for increasing returns. According to Brian Arthur:

> "Mechanisms of increasing returns exist alongside those of diminishing returns in all industries. But roughly speaking, diminishing returns hold sway in the traditional part of the economy – the processing industries. Increasing returns reign in the newer part – the knowledge-based industries. Modern economies have therefore bifurcated into two interrelated worlds of business corresponding to the two types of returns. The two worlds have different economics. They differ in behaviour, styles, and culture. They call for different management techniques, and codes of government regulation. They call for different understandings."[128]

It is widely believed that the outcome of increasing returns, in the absence of countervailing forces, is industry concentration – fewer, larger firms. It is not, therefore, surprising that commercial publishers have grown through mergers and acquisitions and developed ever larger portfolios of titles. It is the natural consequence of being in the industry they are in. The key question is, are these 'monopolies' sustainable? If they are, then it is possible that monopoly power will be exercised in the market place. If not, monopoly power is less likely to be a longer term problem.

Swimming somewhat against the tide of current economic analysis, John Kay suggests that the fear of concentration and winner-takes-all markets in the knowledge economy is exaggerated. "Kay contends that the expansion of the knowledge economy will create a proliferation of materials, firms and activities at all points and at all levels, suggesting that no one can expect to enjoy continued control of these markets."[129] Of particular interest to an examination of the scholarly communication industry, Kay also contends that "…it is misconceived to think that the key lies in being at the point of delivery of the product: the low cost and ease of access to the delivery mechanism [internet] mean that the rents are driven down at the delivery level and instead migrate back up the value chain to those with genuinely scarce factors and competitive advantages."[130]

If these 'genuinely scarce factors and advantages' rest with the content creators (authors), then electronic publishing promises to deliver scholarly communication from the hands of commercial and potentially monopoly publishers into those of the creators. If, on the other hand, they rest with brand holders who turn the quality control and selection processes into key dimension of value in their products, electronic publishing may not revolutionise the structure of the scholarly publishing industry as much as many seem to expect. Nevertheless, if Kay is right, commercial publishers can expect competition from a wider range of players in the scholarly communication product system than is currently the case and, perhaps, from new players that are not yet a part of the system.

4.3.1.2 Pricing information goods

It is widely suggested that some of the commercial publishers are charging prices for some serials that bear little relation to production costs. Odlyzko cites the example of three math journals which are published by a commercial publisher, a university and a scholarly society, respectively. Prices vary by a factor of seven, suggesting that first-copy costs are not the primary factor determining price. Hunter suggests that journals are priced according to what the market will bear, and Tenopir and King have suggested that until recently the market for journals has been relatively inelastic – academic journals are considered to be ‘must have’ items and one cannot easily be substituted for another should the latter become too expensive.

There are a number of reasons why the prices of print journals may not directly reflect the production costs. Firstly, publishers might be spreading costs across a range of journal titles – using high volume titles to cross subsidise lower volume titles. This would see prices increasing faster than costs *if* there were a lot of new low volume titles emerging, because of the relatively high share of first copy in total production costs.

Secondly, publishers might be exercising monopoly power and reaping rents. These rents may or may not be realised as profits. It is not uncommon for monopolists or oligopolists to 'gold plate' – spend more on production than is really necessary – or simply be inefficient. It was, for example, widely held that communications prices were high prior to the deregulation of telecommunications in Australia because Telstra's network was over-engineered ('gold plated') and its processes inefficient.

Thirdly, publishers may be unsure about pricing. With high first copy and very low or near zero marginal costs typical in information goods, one cannot expect to see the marginal cost pricing seen in manufacturing. When marginal cost is close to zero, marginal cost pricing is a bold business strategy. That is not to say that it is all that unusual. When Microsoft entered the web browser market with Explorer it was free (zero priced), and Netscape responded by making its Netscape browser free. Similarly, many internet gateways, portals, search engines, etc. are free, and free-to-air television is free. Of course, these things are usually either advertiser supported or bundled with something that is not free. If one is not going to follow a marginal cost pricing model, then price setting is difficult. It requires a good deal of knowledge about consumer

preferences and demand. And, as outlined below, the scholarly communication 'value chain' is not well geared to generating information about the end user, or passing it back to the producers.

Fourthly, 'charging what the market will bear' has negative connotations, but in an information business perhaps it should not. *If* consumers have full information and can make rational consumption choices, then what they are prepared to pay (what the market will bear) should, despite a low price elasticity of demand, reflect value in use. This suggests that either the consumer lacks sufficient information to make rational purchasing choices, or the value in use is increasing – or both.

As outlined below, we know the former to be the case. Possible ways in which the latter might be occurring include:

- information and communication technologies increasing access to and/or knowledge about the content, and thereby broadening its consumption;
- increased value placed on, and resources devoted to, education and/or research leading to either increased efficiency in the 'use of' content or a bidding up of input prices; and/or
- increased ability of the economy to make economic use of education and/or research thereby increasing the social return to investments in education and/or research and thereby the value of their inputs.

In short, if the economic value of knowledge goes up, then one might expect that the value of the content that is an artifact of that knowledge, and/or an input to it, to go up too.

4.3.1.3 Operating margins

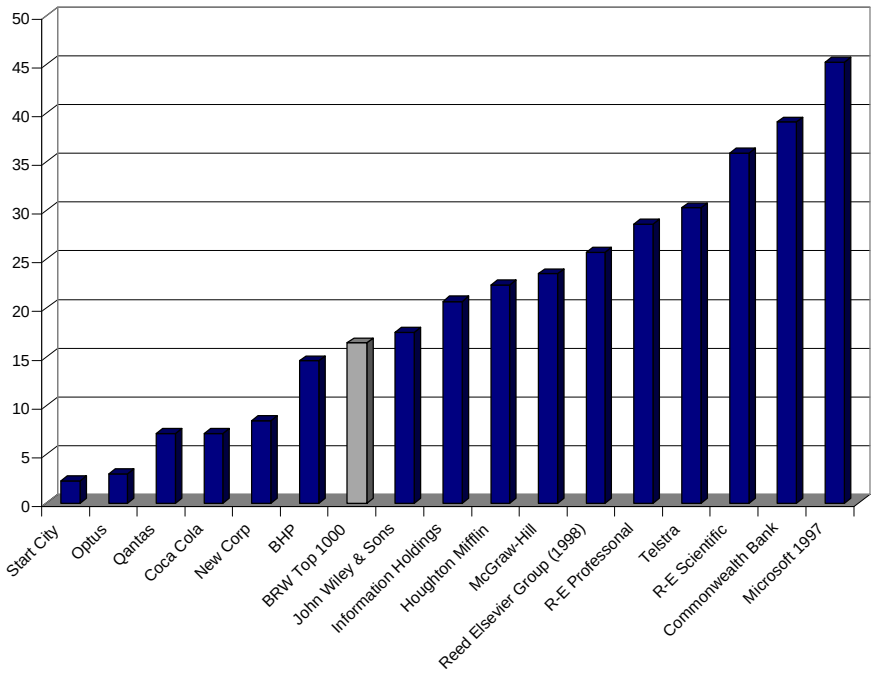
The opposite side of the coin is the extent to which charging what the market will bear is possible. Is competition in the publication of scholarly information sufficient to ensure that prices reflect value, or is there a lack of competition with prices reflecting monopoly power?

Perhaps the best summary on the profitability of major commercial publishers is that of Brendan Wyly.[131] He has shown that in 1997 Reed Elsevier enjoyed a higher net profit margin than 473 of the S&P 500 listed companies, Wolters Kluwer provided higher return on equity than 482 of the S&P 500, and margins generated in the science, technical and medical publishing areas of the companies tend to be even higher than aggregate margins.[132] For example, Reed Elsevier's scientific sales were only 17 per cent of total in 1997, but 26 per cent of operating income came from scientific.

During 1998, Reed Elsevier's operating margin in its professional publishing division was 28.6 per cent, and in its scientific publishing division it was 35.9 per cent.[133] Their scientific margin is down from 40.28 per cent in 1997, 41.77 per cent in 1996 and 39.66 per cent in 1995.[134] To put these margin into perspective: the average gross operating margin of the BRW Top 1000 companies in Australia in 1999 was 16.4 per cent. A

margin exceeded by most international publishers. In terms of Australian companies, we have to go to Telstra with an operating margin in 1999 of 30.3 per cent and the Commonwealth Bank at 39.1 per cent to find margins like those enjoyed by the major commercial publishers.[135]

Figure 4.1 Operating margins of selected companies (circa 1998-99)



Notes: Operating margin calculated as revenue from sales after expenses.
Sources: *BRW Top 1000;* Reed Elsevier (1999) *Annual Report 1998;* Wyly, B.J. (1998) 'Competition in Scholarly Publishing? What Publisher Profits Reveal,' *ARL,* 200; and other sources.

4.3.1.4 Limited market (bundling)

It is sometimes argued that the cost of production of academic journals is relatively high because many have a very limited market, with fixed (first copy) costs spread over a relatively small number of potential users. Of course, at one level this is true, but there are opportunities to grow the market that publishers have perhaps not yet fully explored.

For example, Odlyzko forecasts increasing use of journals by pressure groups, and researchers at Project Muse have found that institutions that had not previously subscribed to Johns Hopkins University Press titles in print have subscribed to journals in electronic form.[136] This suggests that the market may be larger than traditional print publishers had once believed. Perhaps more importantly there are examples from other, related industries of significant sales made to users who do not understand (all) the content. Reference sales, such as encyclopedia, have been made into family homes with limited consumption of the content. And Microsoft is among many software publishers

to have bundled products into suites, such as Microsoft Office, and sold to many users who are unaware of, and unable to make any use of, many of the functions available.[137]

4.3.2 Production costs

There are costs associated with each step in the production process. Estimates of these costs vary as widely as do the publications themselves, and of course there is significant variation across fields. Nevertheless, it is possible to identify approximate and typical costs.

4.3.2.1 Print journal costs

Tenopir and King present costs of the processes and functions which publishers and their representatives perform as part of traditional print journal publishing. They divide activities into five functions: article processing, non-article processing, journal reproduction, distribution and publishing support. They suggest that:

> "The total cost of article processing activities is largely a function of the number and size of articles handled, and, thus, the unit cost of processing articles is important to know. The cost of non-article processing is isolated because it is often ignored in costing scholarly journals, yet it can be a significant cost that must be considered in assessing journal prices. The costs of journal reproduction and distribution are largely a function of number of subscribers, frequency of publication, and the size of the journals. The costs of these functions are important because they are the ones most affected by switching to electronic publishing. Total article and non-article processing costs are fixed costs identified with a particular journal. These are fixed costs in the sense that they are not affected (or affected very little) by number of subscriptions and are most often called first copy or prerun costs. Another kind of fixed cost involves the indirect publishing support costs of marketing, administration (ie., accounting, personnel, utilities, etc.), managing rights and copyright protection, and finance."[138]

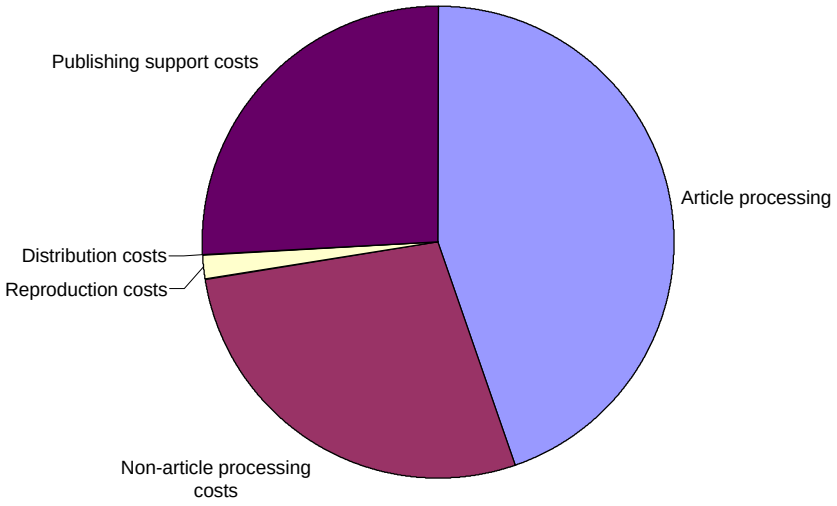
Table 4.1 Typical print journal production costs, 1995

	Cost per page $US	*Share %*
Article processing	165	45
Non-article processing costs	102	28
Reproduction costs	6	2
Distribution costs	0.07	0
Publishing support costs	95	26
Total	368	100

Source: King, D.W. and Tenopir, C. 1998, 'Economic Cost Models of Scientific Scholarly Journals,' *Proceedings of ICSU Workshop*, University of Oxford, 31 March to 2 April, 1998.

Table 4.1 and figure 4.2 show the distribution of these costs derived from the detailed analysis of King and Tenopir. In summary: the first copy costs of a journal article are between $US 2,000 and $US 4,000; typesetting costs about $US 15 to $US 25 per page, making the production costs of a 20 page article about $US 500; and the marginal costs of printing and mailing an issue about $US 3. So a quarterly journal with about 10 articles in each issue would have fixed costs of about $US 120,000 – with 600 subscribers the break even subscription price would be $US 212.[139]

Figure 4.2 Typical print journal production costs, 1995



Source: King, D.W. and Tenopir, C. 1998, 'Economic Cost Models of Scientific Scholarly Journals,' *Proceedings of ICSU Workshop*, University of Oxford, 31 March to 2 April, 1998.

Information technology is bringing down article processing costs, but these proportionate costs are similar to other published examples. The University of Chicago Press (37 journals) and the American Economic Association (3 journals) have been reported to confront editorial costs of 32 and 36 per cent, respectively; typesetting costs of 10-18 and 13 per cent; distribution costs of 24 and 23 per cent; and other (overhead/administrations) costs of 34 and 27 per cent. MIT Press also report similar percentages.[140]

The key features of these print journal costs are:

- high first copy costs, low marginal costs;
- article processing costs are a significant proportion of total production costs;

- non-article processing costs (marketing, administration, etc.) are also significant; and
- physical distribution costs are a small share of total production costs.

The implications being that: with high first-copy costs and near zero marginal costs it is likely that publishers will face increasing returns; significant cost savings could be made by streamlining, automating or obliterating article processing activities; somewhat less significant savings could be made by streamlining, automating or obliterating administration, marketing and other production costs; and because distribution costs are a relatively small part of total costs electronic distribution, of itself, is unlikely to lead to major cost savings (this is not to say that it might not add significant value in use).

4.3.2.2 Changes in print journal costs

Looking at the ways in which print journal production costs have changed over the last 20 years, King and Tenopir suggest that the relative cost of publishing has *decreased*. According to their modelling average cost per page published has declined around 20 per cent since the late 1970.[141] But they suggest that increases in the number of titles, increases in the length of papers and increases in the number of papers per issue go some way to explaining how, despite declining production costs, subscription prices have increased.

King and Tenopir attribute 56 per cent of the price increase between 1975 and 1995 to inflation and the increase in the size (pages) of journals. They suggest that price per journal increases of 17 per cent are attributable to changes in the distribution of circulation – more titles with lower circulation per title. And they point out that price per title changes are aggravated by the more rapid decline in personal subscription (at lower subscription prices) than in institutional subscriptions (at higher subscription prices).[142] In short, there are a range of factors involved whereby declining publisher costs and rising subscription prices can occur together.

4.3.2.3 Electronic journals and dual media

Some argue that there are significant cost savings to be made from switching from print to electronic journals.[143] However, the evidence outlined above relating to the costs involved in print journal publishing suggests that: unless the whole process is geared to purely electronic publication cost savings may be relatively modest, dual mode publication increases costs, and new opportunities for value adding features in electronic form makes cost comparisons difficult – the print and electronic products are different products and exhibit different values in use.[144]

Step one in the transition, preparing a print journal and then putting it online too, just adds production costs. According to King and Tenopir, additional costs of parallel print and electronic publishing (dual mode) appear to be in the range of 3 to 8 per cent.[145] Regier, reporting on Project Muse, suggests that for John Hopkins University Press total costs for both print and electronic editions were about 130 per cent of print only

costs.[146] Production costs for 'purpose built' online only journals will probably be lower, but there may be large overhead costs involved in the IT equipment, software and skills required. King and Tenopir estimate that costs savings in the production of totally electronic journals might be of the order of 7 to 8 per cent on print journal costs.[147] This ignores any one-off or early phase establishment costs, and the skills required of production staff possibly raising labour costs. In the short run increases in both of these costs seem likely.

It also ignores potentially higher first copy costs for e-journals. Shirrell commenting on MIT Press figures comparing print and electronic journal production costs noted that: "…the total first copy costs of the electronic journals average $US 40 to $US 43 per page, and those for the print journals average $US 23 per page. …For a 200 page issue, this would amount to about $US 4,000. …MIT can produce a print edition less expensively than an electronic edition when the distribution is under 500."[148]

These costings focus on production costs, they ignore the very considerable ICT *infrastructure costs* involved, or tend to disguise them by shifting them onto the users. Comparing print and electronic publications costs in 1997, Fisher concluded: "It seems that the direct costs of publishing an electronic journal are substantially below that of a print journal with comparable pages. The overhead costs, however, are much higher."[149] Pure infrastructure costs are rarely discussed in the literature, but as we move towards increased online publication the proportion of costs going to ICT related infrastructure will grow.

The *shifting of costs* up or down the supply chain, which e-commerce of any sort typically involves, also tends to disguise true costs. For example, Halliday and Oppenheim suggest that researchers print most of the material they actually want to read even when it is delivered online – using the online version to search and select material. Assuming the carry forward of recent journal article use patterns into the online world, they calculate that every researcher would incur printing costs of £108 printing e-journal papers per year.[150] Given our estimate of some 220,000 academics, researchers and higher degree by research students in Australia (ignoring legal, medical and engineering professionals), and given an exchange rate of 40 pence, this would imply a cost shifting to the consumer of some $59.4 million per annum for printing alone! While some proportion of this would be offset by reduced photocopying costs, it is still a sizeable impost.

Moreover, simply turning print journals into their online equivalent is unlikely to be very attractive to producers, unless they see ways to increase revenue and new opportunities for value adding through, for example, enhanced accessibility and searchability, adding hyper links between papers, or creating de facto vertical portals ('vortals') from titles or portfolios of titles in subject areas. None of these sorts of value adding alternatives are likely to make access to the materials substantially cheaper in their electronic form in the near term. However, they may add value in use sufficient to justify continued high, even increasing prices.

4.3.2.4 Texts and monographs

Book production costs are less widely discussed, but their composition is not likely to be very different to those of journal production given that the peer review process that is a feature of journal publication is largely unpaid.

The market for monographs is typically global, whereas that for textbooks tends to be more national – with texts tailored for 'local' use. Monographs may sell few copies in any one country, but sell globally; whereas textbooks may sell many copies, but only in one country. Either way, the critical factor for the publisher is to estimate the size of the market as accurately as possible in order to avoid unsold inventory or lost sales opportunities.[151]

Electronic publishing of monographs and texts offers some opportunities for innovation, cost savings and value adding, but suffers from the great drawback that few users are willing to read long works online. Nevertheless, having the works online can be important in the decision to buy – enabling the reader to consume enough of the text to know that he/she wishes to buy. The experience of university presses in the United States is that if monographs are made available free of charge on internet, sales of hard copy increase two or three fold.[152]

Perhaps the greatest opportunity for innovation lies in the cross-over between reducing cost and adding value. For example, Wiley's custom publishing service offers teachers the facility to select chapters from a large database of standard texts and custom build a textbook suitable for their course; which is then printed, bound and delivered by Wiley.[153] To date, value adding features for books, such as reviews, reader ratings, links to related works and works by the same author(s), have been pioneered primarily by innovators in the distribution part of the scholarly communication product system rather than publishers themselves – as a visit to Amazon.com readily reveals. But there may still be opportunities for publishers to pursue innovative value adding activities.

4.3.3 Incurring costs versus adding value

It is important to examine costs in terms of value added. Are all the activities that are incurring costs adding value?

4.3.3.1 Incurring costs

Looking at typical print journal production costs in the brief review outlined above one is inclined to wonder how much value is added in incurring some of those costs.

According to Varian,[154] typesetting costs for the average print journal are about $US 15 to $US 25 per page, making typesetting costs of a 20 page article about $US 500. Hence typesetting to produce a uniform format adds something of the order of $US 4,000 per issue to the first copy production costs of a 200 page journal, or $US12,000 per year if it is quarterly. If only 10 people read a particular article, they are paying $US 50 each for the formatting and uniform style. While Varian is reporting costs from the print era, and

ICTs are facilitating significant cost reduction in such areas as article processing, the obvious question is: is it really worth it?

Although there is little information, marketing costs seem relatively high. According to Tenopir and King publishing support costs, including general administration and marketing costs, amount to some $US 95 per page for print journal publishing and account for 26 per cent of typical production costs.[155] When most sales are on the basis of annual subscriptions these costs seem high. It is important to examine these and other production costs, and ask whether they are really necessary, and add whether they add sufficient value in the eyes of either the authors or readers to be considered cost effective.

4.3.3.2 Adding value

There are many ways in which electronic publishing and distribution open up new opportunities for adding value – as well as reducing costs.

Increased accessibility and pure non-rivalrous consumption: In electronic form papers can be delivered to the desktop. The researcher costs involved in leaving the office, going to a library, searching for and possibly not finding a paper when it is needed are very considerable. Not only in terms of time, but in terms of breaking a train of thought. Moreover, whereas only one person can be reading a book or journal at any given time, electronic delivery offers truly non-rivalrous consumption. Both value in use and potential social returns are higher in the online world.

Enhanced capabilities: All the possibilities for hyperlinks to referenced and related works, automated alerting services and so forth provide enormous potential to enhance the value of the content to users.

Better information: Because of the mediated nature of the purchase and consumption of scholarly publications, market signals have been very weak and information about use and preferences highly imperfect. Electronic publishing and delivery open up the possibility of collecting and analysing an almost infinite amount of information about the who, what, when, where, how and why of use/consumption. Better understanding demand and aligning supply will add value, and offer the opportunity to add value again through tailoring the kinds of enhanced capabilities online delivery makes possible to actual needs.

Shifting patterns of use: While it is still early days in the use of electronic publishing and delivery, evidence suggests that (i) patterns of use of material are very different to those known, or thought, to have occurred with print materials, and (ii) online use appears to be much more intensive *and* extensive.[156]

> "The high elasticity in the use of information that results from increased access is proven with each new service that OhioLINK provides… On average, each Ohio university owns 362 titles published by Elsevier and Academic Press combined. In the 12 months from June 1998-June 1999, patrons downloaded articles from an

> average of 1,135 titles per university, a more than tripling in titles used over print access."[157]

If these new patterns represent better alignment of demand and supply than has been possible in print form, then they reflect enhanced value in use. And, clearly, greater use reflects a higher return on investment in the content by libraries *and* suggests higher social returns through enhanced dissemination.

4.3.4 Business models for publishers

Content production firms (publishers) can, and do, pursue a range of possible business models. Because they deal in content products, their business models may not be those we observe in manufacturing, agriculture or mining which inform common perceptions about business operation. They do, nevertheless, depend upon the underlying economics of information, which see publishers of scholarly content rely extensively on bundling and subscription.

4.3.4.1 Bundling and the subscription model

Information product producers often seek to maximise revenue through bundling – selling distinct products together as a package. Hal Varian provides an outline of how bundling works in scholarly communication.

> "One of Microsoft's most successful products in recent years has been Microsoft Office, which is a bundle of different software products. Similarly, academic journals are a bundle of articles and a subscription to a journal is a bundle to issues. More recently, producers have been offering bundles of subscriptions of related journals at special rates.
>
> In order to understand the economics of bundling, let us… consider a simple example of two mathematics professors and two journals, the *Journal of Addition* and the *Journal of Subtraction.* Professor A , an expert in addition, is willing to pay $120 for the *Journal of Addition* but only $100 for the *Journal of Subtractio*n. Professor B is an expert in subtraction, and has just the opposite willingness to pay: $120 for the *Journal of Subtraction* and $100 *Journal of Additio*n.
>
> If the producer sells both journals at the separate prices, his profit maximizing strategy is to set a price of $100 for each. Each mathematician will buy both journals, yielding a revenue of $400. But suppose that the producer offers a bundle of the two journals: if the willingness to pay for the bundle is just the sum of the willingness to pay for the components, each professor would then be willing to pay $220 for the bundle. This yields the producer a revenue of $440!
>
> Bundling is profitable in this example because it reduces the heterogeneity of the consumers' willingness to pay: …if consumers have different willingness to pay, and the producer cannot price discriminate, all the consumers who buy the product buy at the price of the buyer with the lowest willingness to pay. By creating the

> bundle, the producer can sell at the *average* willingness to pay, and this will typically be more profitable.
>
> Indeed, this is one of the rationales for having journals in the first place. A journal is simply a bundle of articles and it is likely the case that there is much more heterogeneity in valuations of individual articles than there is in bundles of articles. Hence bundling articles together will generate more revenues than selling each individual article at a flat price."[158]

The traditional pricing mechanism for journal publishing (annual subscription per title) is good for publishers because it creates a very low risk market, with consumers paying subscriptions in advance.[159] This makes the subscription model a very attractive one for publishers, and they are likely to resist moves towards usage pricing, such as pay-per-view, for as long as possible.

Major commercial publishers have grown large portfolios of titles, both internally through the introduction of new titles and externally through mergers and acquisitions. There are a number of reasons for this. One motivation is to reap economies of scale in production – in handling, typesetting and printing, in the overhead costs of subscription and payments management, and in general administration. And there is evidence that such economies can be realised.[160] A further motivation is to increase the value of the brand, and lower the transaction costs of accessing a portfolio of titles covering specific areas.

Of course, the portfolio of titles is also bundling. Many publishers are now bundling their entire 'lists' and selling them to institutions on a subscription basis using site licensing to control access. This not only ensures payment in advance and revenue maximisation through bundling, it also secures payment for marginal and low use journal titles which the subscribing institutions might otherwise cancel – thus perpetuating the production of what might otherwise be non-viable titles and aggravating the 'serials crisis' by increasing the number of products on the market and thereby increasing aggregate fixed (first copy) costs.[161]

Bundling lists and selling on subscription tends to increase monopoly power by reducing divisibility and substituteability, maximise revenue by pricing at the average willingness to pay, and provide greater certainty of revenue year to year.[162] On a more positive note, bundling done well can reduce user search costs by making related material more readily accessible, and library distribution costs by reducing inter-library loan and document delivery traffic, which is often labour intensive.

4.3.4.2 Books and approval plan purchasing

Books are typically individually priced, but many research libraries purchase books on an approval plan basis. Acquisitions librarians monitor the output of various publishers and the requests they receive from faculty, and are thereby able to form a judgement as to the relevance and quality of the output of various publishers in the various fields of scholarship. Publishers offer approval plan purchasing in thematically organised fields

of publication, sending everything they publish to the libraries who subscribe to the plan on an approve or return basis.

Clearly this reduces transaction costs – acquisitions do not search and process so many orders, and publishers have some certainty of market. From an economic point of view, however, the main characteristics of approval plan purchasing are the familiar ones of bundling and branding.

4.3.4.3 Price discrimination

Price discrimination occurs when a producer sells at different prices to different consumers. It is a mechanism that allows producers to maximise revenue, but the impact of price discrimination on market supply varies quite dramatically according to the willingness of various would-be consumers to pay. If willingness (or ability) to pay is heterogenous, then revenue can be maximised by focusing only on those customers with a high willingness to pay. Again Hal Varian provides a simple explanation:

> "If all customers for the product place essentially the same value on the product, the profit-maximizing pricing decision is easy: just price the product at this common value and charge what the market will bear. The difficulty arises when consumers' willingness to pay are heterogeneous. In this case the producer's choice is not so obvious, since fewer consumers will buy at higher prices. Furthermore, if willingness-to-pay differs across customers, the producer would generally find it advantageous to charge different users different prices. As we will see below, this will be true even for a producer who is only interested in cost recovery [eg. a scholarly association]. I will illustrate some of these phenomena via a series of examples involving the demand for an electronic book. In each example the cost structure will be the same: $7 to produce the first copy of the book, and the second copy can be produced at zero incremental cost.
>
> *Example 1:* There are two consumers, A and B. A is willing to pay $5 for a book, B is willing to pay $3 for the book. Note that the total benefits 8 = 5 + 3 exceed total cost, 7, so it is socially desirable to produce the book. However, the producer cannot recover his costs at any uniform price: if he charges $5 only one consumer will buy the book, so his revenues will be $5. If he charges $3, both consumers will buy, but revenues will only be $6. If the producer can price discriminate – sell to different users at different prices – then it will be possible to cover the development costs of the book.
>
> *Example 2:* A is willing to pay $8, B is willing to pay $3. In this case, total benefits minus total costs would be maximized if both parties got copies of the book. But again this outcome cannot be supported at any uniform price: the highest price at which both parties would buy is $3, and this generates inadequate revenues to cover the cost. However, if the producer could charge different users different prices, he would find it profitable to sell books to both consumers.

> *Example 3:* A is willing to pay $20, B is willing to pay $8. In this case, a producer who is only interested in cost recovery could price the book at $3.50 and be assured of recovering his costs. But a profit-maximizing producer would pursue a very different strategy: it is in his interest to price the book at $20 and sell only to the high end of the market. Note that this is the case *even though consumer B is willing to pay the entire cost of production!*"[163]

This latter example offers one potential explanation for Odlyzko's findings in relation to the widely varying prices of three comparable math journals, with commercial publication motivated by profit maximisation and association publishing motivated by cost recovery.[164]

Despite its somewhat negative connotations, price discrimination is not necessarily a bad thing – as example 3 demonstrates. Price discrimination can be win:win. It can allow producers to extend supply to a low demand/low willingness to pay segment of the market that would not otherwise be served at all – providing the producer is able to protect the revenue from the high willingness to pay segment of the market.[165] It is notable that in the PEAK project operated by the University of Michigan, which aimed to explore bundling and price discrimination, the traditional subscription model appears to have been the least popular of the pricing models tried.[166]

Key questions in developing a price discrimination strategy are: (i) how to prevent consumers with a high willingness to pay gaining access to the cheaper product, and relatedly (ii) what are the best dimensions for discrimination. Given that the consumers' willingness to pay is based on their judgments about the value of the product to them in use, it is value in use that provides the clue.

Potential dimensions of discrimination include such things as:

- peak versus off-peak times (congestion pricing) – eg. electricity, phone calls, etc; and in the case of journals, perhaps, close to exams![167]
- professional, institutional versus student users;
- speed of access and use – eg. the IBM laser printer series E was a low cost alternative to the IBM laser which printed at half the speed, but it was identical in every respect except that it had 5 extra chips that inserted wait states to slow it down;[168]
- screen resolution;
- accessibility/cost – eg. local 'mirror site';
- ability to print out easily;
- inline versus nested graphics and tables;
- active hyperlinks;
- formatting and presentation;
- level of abstract access; and

- availability of separate abstracts and summaries.

Electronic publishing will allow much greater flexibility in affecting price discrimination strategies: it will allow greater control over the time, place, pace and quality of access, more feedback as to actual patterns of use, and far greater potential for incremental value adding developments which can provide new dimensions for discrimination which might substantially extend the market, thereby reducing costs by spreading fixed costs.

4.3.4.4 Individual article delivery and pay-per-view

Price discrimination and technological possibilities are likely to lead to increased variety in pricing and access models, one dimension of which is likely to be fragmentation and increasing individual document delivery using a range of pricing models of which pay-per-view is the most extreme.

Disaggregation of bundles can be positive in terms of increased opportunity for price discrimination, but can also be negative in that it reduces the ability of publishers to cross subsidise. In the current model of journal publication, papers are selected primarily on quality and fit with the topic of that particular journal title. Some of the articles in the edition, the title or list subscription prove to be relatively high use, while others are low use. Those articles that are high use effectively cross subsidise those that are low use. One of the dangers of disaggregation and sale of individual articles on a pay-per-view or similar basis is that popularity at the time of publication may become a criteria for selection, and immediate popularity might not be quite the same as relevance to the field of scholarship. In the extreme case of an electronic journal sold on both a subscription and an individual papers basis, there might be some pressure to select for publication on the basis of immediate popularity ahead of long term academic merit.

Other dangers include: and loss of access to the network of scholarship that a journal title might represent; the loss of themes developed by journal editors which might be deliberately provocative and leading, and in that sense make the journal issue or even series worth more than the sum of the parts; and a decline in the well practiced research technique of serendipity – eg. looking for a particular article and then reading another in the issue out of curiosity.

4.4 Economics of distribution

In this section we look at some of the costs involved in the distribution process and explore the economics of distribution of scholarly content, focusing on research libraries.

4.4.1 Library distribution costs

Making material, be it serials, textbooks, monographs, datasets or electronic journals available in libraries carries considerable costs.

4.4.1.1 Processing and storage costs

Focusing on the 'serials crisis', Cooper estimated the cost of storing a single issue of a journal in the average library at $US 25 to $US 40 per annum.[169] Bowan estimated that the total handling costs of a title in United Kingdom research libraries varied from around £60 to £113 per annum (an average of £86).[170] Odlyzko suggests that the journals 'crisis' is really a library costs crisis, claiming that for every $1 spent on journals a further $2 was spent of library processing and storage costs.[171] However, he based this calculation on the ratio of serials subscription costs to total costs. If one distributes total non-content library costs across serials and non-serials for Australian research libraries in 1998, then serials related library costs amount to $1.77 for every $1 spent on serials (approximately $166 million in 1998).[172]

Using citations data, Lesk suggested that 22 per cent of scientific papers published in 1984 were not cited during the subsequent decade. This figure rises to 48 per cent for social science papers, and no less than 93 per cent for humanities papers. If citation were considered use, then per use costs of journal papers would be high indeed. Costs per article read are, of course, lower – assuming that many reads do not lead to citation. Costs per read also vary widely between disciplines. Odlyzko suggests that the cost per reader of mathematical articles is of the order of $US 200, whereas Varian quotes the director of a major United States medical library saying that his policy is to cancel anything for which the cost per read appears to be over $US 50.[173] Work at Stanford University suggests that 'high use' material is anything less than $US 50 per use, while 'low use' material costs some $US 200 or more per use.[174]

Odlyzko raises an important issue in pointing to library handling and processing costs by highlighting the significance of those costs in overall system costs of delivery – including costs of creation, production and distribution. There is a need to consider library costs in any attempt to streamline the scholarly communication system and to exploit the shift from the print to the online paradigm in such a way as to address whole of system costs.

4.4.1.2 Other library costs

Licensing and negotiation costs: Halliday and Oppenheim suggested that license negotiation costs amount to some £1,650 per annum per institution to do individual negotiation. They also note that negotiating deals is not really worthwhile at the individual institutional level given that subscription discounts of 10 per cent or less are all that can usually be expected. They conclude that collective or consortia purchasing and license negotiation is the only way to handle these issues in a cost effective manner.[175]

Archiving costs: are a disputed area. There are two issues involved. First, is the cost of provision of ongoing access to material no longer subscribed to, which is emerging through agreements between publishers and libraries as a responsibility of publishers. Second, is the cost of providing national archives in perpetuity. These costs include the housing, preservation and upkeep costs of physical collections, digitalisation and maintenance costs of electronic resources, and so forth. As is the case with current collections, knowing what is a reasonable upkeep cost is difficult because there is little guide as to the value of the asset, and how it may or may not be depreciating.

4.4.2 Economic incentives, practices and outcomes

As a principal mechanism for the distribution of scholarly content research libraries face a range of economic incentives and grapple with a number of complex economic issues. The most striking thing to an outsider is that while research libraries may have perfected ways to communicate scholarly content, they are a very long way from perfecting mechanisms for the effective communication of market signals. There are, of course, a number of structural and institutional reasons for this.

4.4.2.1 Funding allocation and purchasing practices

One of the forces shaping the economics of distribution is the institutionalised nature of the funding allocations that underwrite purchasing and accession. To characterise the practice typical in the print environment, which may be explicit or implicit, funding is allocated on a block basis and divided into annual budgets for the range of academic fields the institution seeks to serve according to the relative priorities given to each field in the strategic plan of the institution. Libraries then purchase materials (both serials and monographs) in each field, up to the limit of their annual budget for that field on the basis of advise from faculty members and professional library experience.[176]

Journal subscriptions: Both libraries and publishers like the certainty of subscriptions, because the annual library cost is known and publishers revenue guaranteed, regardless of actual use or value to the consumer.

The decision to subscribe to print journals is, broadly speaking, based on two key factors – price and expected use. McCabe suggests that, be it implicitly or explicitly, most libraries appear to construct a cost per use ratio for each journal title. They then rank journals in each field on a scale from the lowest cost per use to the highest cost per use, and identify the cut off point implied by their available budget for that field. If they do not reach the limits of the budget in this process, they can add more journal titles to their collection. If, on the other hand, the limit of the budget is reached inside the bounds of their current subscriptions, they must cancel titles. Generally speaking, libraries seek to maximise their coverage in each area by purchasing as wide a range of titles as possible and avoiding duplicate subscriptions wherever it is possible to do so.[177]

Under this system its more profitable for publishers to sell high use journals widely, so prices are lower. But with lower use journals publishers can gain by raising prices and

selling only to those libraries to which price does not matter – big budget libraries that value their ability to cover the whole field.[178] There appears to be relatively little price discrimination in the subscription model, so lower budget libraries are simply not served – at least not at a price they can afford. Example 3 in Varian's summary of the operation of price discrimination, outlined above, explains why it is not in the interest of profit maximising publishers to sell at a lower price unless they practice price discrimination.

Book purchasing: Books are typically individually priced, but many research libraries purchase books on an approval plan basis. Publishers offer approval plan purchasing in thematically organised fields of publication, sending everything they publish to the libraries who subscribe to the plan on an approve or return basis. Clearly this reduces transaction costs – acquisitions do not search and process so many orders, and publishers have some certainty of market.

Purchasing decisions are made either on a similar block budget basis to that used for journals, with some proportion going to specific purchase recommendations from faculty relating to their courses, research, interests and/or scholarly network, and the remainder (which is usually a larger proportion) going to approval plan 'arrivals'. As is the case with journal subscriptions, end user use or demand is at best estimated.

4.4.2.2 Market signals

There are a number of important things to note about these print purchasing practices:

- journal titles and books compete with each other *as substitutes* across broad fields, rather than being considered separately;
- the budget for purchasing in each field is determined by the strategic priorities of the institution, such that titles across fields do *not* compete on cost per use;
- the budget for each field is determined (largely) independent of price information;
- the budget for each field is determined (largely) independent of demand or usage information;
- the budget allocations to each field take little or no account of price per use within those fields; and
- price signals rarely reach consumers (researchers or educators).

These features of the print-based system add up to two related things. First, an almost complete failure of market signals – especially of price signals to the end consumer. Second, very low price elasticity of demand – large price changes have relatively little effect on demand.[179]

In general, wherever one sees low price elasticity of demand one sees high prices, and wherever one sees high price elasticity of demand one sees low prices. Improving the transmission of price signals to the consumer should be a priority for anyone who wants to see lower prices.

Other steps that might be taken to improve the transmission of market signals include:

- increasing the flexibility of budgetary allocations between fields, thereby increasing substituteability;
- mobilising the power of IT and online publication to improve information about actual use, and feed it into purchasing decisions; and
- devolving budgets to users and/or user groups, thereby improving price signals.

4.4.3 The channel

Distributors, Consolidators and Subscription Agents: While specialist distributors, consolidation and subscription agents play an important role in the distribution of scholarly content, their niche is relatively uncontroversial from an economic point of view. Subscription agents rely principally upon their knowledge of local conditions and customers, together with their ability to win discounts for bulk orders, to put together attractive bundle deals. Distributors and consolidators find a niche business in their knowledge of, and ability to source material (competencies), and providing a service to clients that reduces their transaction costs.

Wholesale-Retail: The wholesale and retail distribution channel for periodicals and books is focused more on non-scholarly than scholarly communication. As such it is at the margin on the core scholarly communication product system. Nevertheless e-commerce and online publication are likely to bring both opportunities and threats for those operating in the wholesale and retail industries.

On the one hand, online bookstores represent a serious threat to traditional small bookstores. On the other, getting online, especially in cooperation with a major such as Amazon.com's affiliates program, could extend the reach and vastly grow the customer base of such stores. Major online bookstore players might also be able to offer services that challenge the existing specialist distributors, aggregators and consolidation agents, perhaps even libraries – threatening significant disintermediation.

4.5 Economic characteristics of scholarly communication

There are a number of key economic features of the scholarly communication product system that go a long way towards explaining its operation.

High first copy costs and low marginal costs of production mean that unit price must be high enough to cover first copy costs, and cannot be set at marginal cost unless an alternative cost recovery mechanism is in place.

Circulation is critical, with extending circulation essential to reducing unit costs. Smaller circulation journals and lower demand books tend to be more expensive. Lack of information about circulation ex ante makes price setting difficult.

Limited substituteability of products, with purchasers unable to easily swap to alternative titles. However, our outline of the acquisition practices of libraries suggests that titles do compete across broad fields, publishers and distribution agents are creating increasing variations on title portfolios and subscription packages available, and the sheer volume of content ensures that consumers must allocate limited reading time. All of these things imply a higher degree of substituteability than may at first appear to be the case.

Inelastic demand (low price elasticity of demand) with sales relatively unresponsive to price changes. However, with the advent of electronic publishing and dissemination radical extensions to circulation and access have become possible. It is not yet clear whether markets can be extended to marginal consumers, given the specialist nature of the content, and what effect those marginal consumers would have on price elasticity of demand. But the situation is changing, with higher price elasticities likely.

New entrants increase aggregate fixed costs, with new publishers and new titles increasing the aggregate level of fixed costs, because each new title has high first copy costs.

Cummings et al. suggest that the demand side of the equation is affected by both library budgets and the pressures exerted by readers, especially faculty members, to purchase journals.[180] We have noted the role that publication plays in peer recognition, promotions and salary increases for authors. Noll and Steinmueller suggest that:

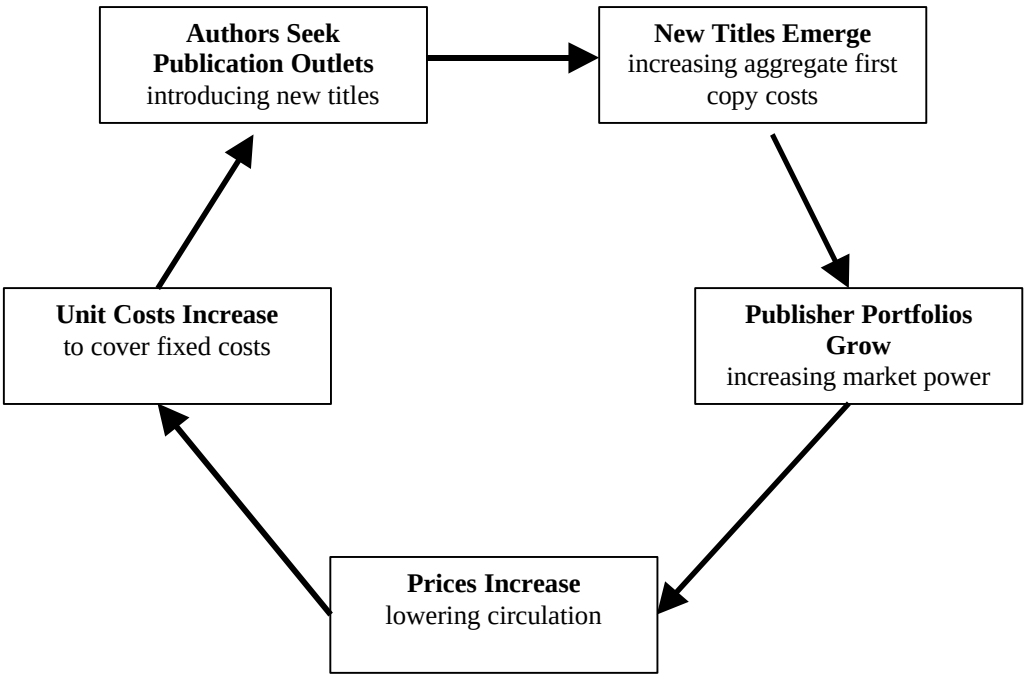
> "...as more faculty seek publication outlets, the demand to be published in a fixed number of 'best' journals grows, and a smaller proportion of scholars succeed in publishing at the top of the hierarchy. Recognizing this, both publishers and scholars seek to create new publishing outlets that create a new hierarchy, rather than enter at the bottom of an established one. Thus, scholars and publishers seek to narrow the scope of journals, attempting to create an outlet that will be read by people in a subspecialty and that will attain the status of being the second best place to publish for that subspecialty, rather than the twentieth or thirtieth best place to publish in the entire discipline. The result is a special kind of journal proliferation. As more academics seek to publish, and as more universities try to promote faculty research and reward scholarly publication, faculty and publishers jointly seek to create not only more journals, but ever more specialized journals that become important to all scholars in a subspecialty, although irrelevant to most scholars and students in a discipline… Journal proliferation and specialization drive down the average circulation of journals, which drives up the average subscription price."[181]

Cummings et al. point out that this set of relationships underlying the production of scholarly journals is likely to produce exactly the pattern we observe. Namely:

- the size of the periodicals universe increases;

- relatively fixed materials budgets at libraries result in a decrease in the number of subscriptions per title, as available resources are redistributed among a greater aggregate number of available titles in the periodicals universe;
- prices per title increase as publishers seek to recover first-copy costs from smaller subscription bases;
- libraries redeploy materials expenditures in response to periodical price increases, protecting serials subscriptions at the expense of other library materials but still cutting back on some subscriptions; and
- library budgets are encumbered by rapidly rising outlays for serials.[182]

Figure 4.3 A feedback loop of escalating prices for scholarly content



Source: Centre for Strategic Economic Studies (CSES).

Cummings et al. go on to say that, while most of the existing literature focuses on the economics of scholarly journal publication, there is evidence of a similar kind of market dynamic in the production and acquisition of monographs. They suggest that the average number of hardcover copies sold per title in the humanities and social sciences has declined. The smaller press runs caused by this decline in copies sold per title put upward pressure on unit prices, because first-copy costs have to be spread over a smaller number of units sold.[183]

The set of interrelationships between the market characteristics of information and cost structures, patterns of demand and acquisition practices, and the forces encouraging

increasing scholarly output go a long way towards explaining the operation of the scholarly communication product system and the genesis of the, so called, crisis in scholarly communication. The challenge is the find points of leverage within this dynamic that can enable us to break the cycle.

5 Issues and Future Study Directions

In this chapter we attempt to tie together some of the threads in order to suggest possible options for consideration. We also outline some future study options based on the preliminary research undertaken in the course of developing this discussion paper.

5.1 Issues and options for consideration

In a short discussion paper it is impossible to canvass the full range of, or do justice to, the complexity of the issues being faced by the various players in the scholarly communication product system. There is no obvious solution, no single solution, and no easy solution to the difficulties currently faced by those seeking the cost-effective dissemination of scholarly information. Nevertheless, at the level of general principle one can see broad avenues for consideration.

If the problem can simply be stated as stemming from high prices, then:

- If, on the one hand, we believe that prices reflect the costs of production, then we must reduce costs in order to reduce prices.
- If, on the other hand, we believe that prices reflect what the market will bear, then we must either ensure that what the market will bear reflects value in use to ensure that the prices are justified, or reduce what the market will bear in order to reduce prices.

This suggests, respectively:

- automating and improving the efficiency and effectiveness of the processes of creation, production and distribution through, for example, increasing application of IT throughout the scholarly communication product system;
- improving the mechanisms for the transmission of market signals throughout the scholarly communication product system; and
- further developing collection rationalisation, cooperative and consortial activities.

5.1.1 The way ahead

There are clearly two broad avenues of market-based 'solutions'. Some are market conforming, others market distorting.[184]

5.1.1.1 Market conforming approaches

Market conforming approaches to the current 'crisis' involve pursuing avenues to improve the transmission of market signals throughout the scholarly communication

product system, create an effective structure of incentives throughout the system, and increase competition in scholarly publication.

5.1.1.1.1 Transmission of market signals

Improving the transmission of market signals might be achieved by such means as:

- *increasing the price elasticity of demand* by sending price signals and devolving choice to the end consumer, by, for example:
  - stamping the price on each journal (in the print environment);
  - moving where possible towards usage-based, rather than subscription-based distribution business models, or a mixture of the two which increases emphasis on usage-based models;
  - moving where possible towards pay-per-view (at title, article or even page level);
- *increasing competition between titles* by introducing greater flexibility of budget allocation; and
- *increasing product divisibility* by using mixed subscription and on request pricing models.

5.1.1.1.2 The structure of incentives

Creating an effective structure of incentives throughout the scholarly communication product system is essential. In essence economics is about creating a system of incentives that produces an outcome conforming to the maximisation of net social welfare. One spanner in the scholarly communication system works is the set of institutional incentives facing authors. By tying promotion, pay, tenure, research funding and other basic rewards to publication in a few, key, refereed journals in each field, universities and research institutions are creating a rod for their own back.

As journal titles have proliferated, prices increased and circulation fallen away, the print journal publishing system has evolved into a mechanism for the development of academic CVs, and is failing to meet the needs of researchers for communication and dissemination. Alternative, parallel systems for communication, dissemination and publication are emerging, with all the overhead costs that that implies. One important reform is to change the institutional incentives facing authors, so as to bring journal publication and scholarly dissemination through the cost-effective publication of ideas back into line.

5.1.1.1.3 Encouraging competition

Encouraging competition in the scholarly communication industry might involve a variety of things aimed at developing new mechanisms for communication, publication and dissemination, and encouraging new entrants to join the scholarly publishing industry.

This might include such things as:

- exploring a wider range of electronic communication, dissemination and publishing options – such as making initially closed scientist discussion groups open for outside view after a set period, and examining alternative ways to affect quality control (eg. the kind of comments registers held at Amazon.com);
- starting new published journals or collections – while the effectiveness of SPARC (Scholarly Publishing and Academic Resources Coalition) is doubtful, it having simply increased the number of journals that must be bought and thereby exacerbated the problem, there is scope for the creation of alternatives to current high-priced titles through, for example, buying out the editorial teams of major journals in order to reduce the barriers to entry by, effectively, buying a significant part of the branding and quality 'value';
- developing alternative win:win business models for publishers and their clients – such as moving ahead on the basis of agreed minimum expenditure/revenue levels for 1 to 3 year terms, subject to review as the transition to online access unfolds;
- exploring more radical bundling and/or price discrimination models – such as, for example, putting entire portfolios (eg. Science Direct) 'free-to-air' on internet while working with IT companies (eg. Dell, Compaq, IBM, Microsoft) on bundling the software access 'key' to it with every desktop and home computer sold;
- encouraging the entry of new players – such as IT companies who have core competencies for the digital era, which publishers do not yet have; and
- extending the use of pre-print server style publication, in combination with exploring ways to overcome the quality control and authenticity issues.

5.1.1.2 Market distorting approaches

Consortial purchasing and national site licensing operate by confronting producer (publisher) power in the marketplace with increased purchaser power – fighting monopoly with monopsony.

A national site license approach, such as that adopted in Canada, implies government intervention and financial support. Consortial purchasing simply recognises the common needs, and funding sources, of Australia's research libraries, and provides the opportunity for them to exercise their collective purchasing power in the market place. Both provide avenues for addressing the 'crisis', or at least turning the tide, and buying time during which the transition from the print-based to an entirely electronic system can be worked through.

5.2 Future study directions

We hope to have demonstrated the usefulness of thinking separately about the activities involved in the three stages of creation, production and distribution in the scholarly

communication system, while at the same time seeing them as elements of a wider system.

Publication has been the main mechanism for scholarly communication and dissemination, but it may not be in the future. Indeed, it may not be now. As Andrew Odlyzko pointed out in a recent paper at the PEAK 2000 conference, scholarly *communication* is changing rapidly, but scholarly *publication* is not keeping up.[185] The widening gap between scholarly communication, on the one hand, and publication, on the other, seems to be at the crux of the issue.

5.2.1 The practice of research

One key question for future study is: *how is the practice of research changing?*

There are a number of inter-related dimensions of change:

- information and communication technologies are revolutionising scholarly communication and dissemination – not only is IT an indispensable tool for analysis in many areas (eg. the human genome), it is also providing new opportunities for low cost, almost instant communication of documents, and easy international collaboration;
- pressures on research funding, and pressures for the commercialisation of research are increasing – resulting in very different needs for communication and dissemination, with the underlying tension between the scientific demand for publication and dissemination and the commercial need for confidentiality;
- these pressures are also leading to a bifurcation – with some remaining in the traditional academic world of time-rich, cash-poor research, and others moving into the increasingly commercialised world of *relatively* cash-rich, time-poor research and demanding very different information access;
- research and education are becoming less institutionalised – being practiced in a much wider range of organisational and institutional settings than before; and
- commercial applications of science are becoming increasingly multi-technology and multi-disciplinary.

The key question is: how are these changes affecting the ways in which researchers communicate and access information?

Studies now emerging on how researchers use online access to papers and how different it seems to be from how they used, or were thought to use, print, are very interesting and important.[186] They tend to reveal that use of online publications is much more intensive *and* extensive than use of print – people access more articles and a wider range of titles. Of course, the online and print environments are not comparable. Both ease and price of access to online materials contribute to greatly reduced costs for users, which is bound to lead to higher levels of use.

Explaining the different patterns of use is somewhat more difficult, but it may be due to bringing the library collection to the users' desktop. When the collection is housed in a library users must travel there to access that information. To ease access to core materials researchers typically held personal collections in their offices, and used the library to fill in the space around the core collection. When ready online access exists the online usage will reflect both of these 'collections' – that of the individual and that of the library. Hence, use of online materials will look quite different to library use of print materials – both in the sense of a different range and larger quantity.[187]

Usage studies are interesting, but they tend to take a supply-side perspective. The really interesting study would be from the demand-side – looking at the practice of research, how it is changing and what that implies for access to, and demand for, information both now and into the future. Such a study would need to take a very broad view, looking at the ways in which science is practiced in various institutional settings, disciplines and techno-economic paradigms. It would begin from studies in the history and philosophy of science and innovation, and try to draw out the implications of a range of fundamental changes in the practice of science for the scholarly communication systems.

5.2.2 Pricing models

In developing pricing strategies for the emerging online publication paradigm there are opportunities to learn from other industries that have experienced, or are experiencing similar transformations.

There has, for example, been an enormous amount of work gone into developing pricing models in telecommunications; with deregulation and the introduction of competition, digitalisation of the communications network and the introduction of rate-based regulation – involving price-capping and graduated rate re-balancing. Rate-rebalancing in telecommunications is about managing the transition from monopoly supply, with many inherent cross-subsidies and relatively little information about actual costs, to competition, with the need to bring prices into line with attributable costs, in an environment that is essentially network-based, during a period of rapid technological change, with digitalisation of formerly analogue networks, and the implied need for significant network infrastructure investment. During this transition a key issue has been how to manage the balance between fixed charges and usage charges in such a way as to achieve sufficient revenue from fixed (access or subscription) charges to provide for ongoing infrastructure investment, while at the same time ensuring that usage charges are set with reference to the directly attributable incremental costs of that usage.

While there are clearly differences between telecommunications and online publishing businesses, there are also strong parallels. The implications of various mixes of fixed (subscription) and usage charges in such industries as telecommunication and electricity, how pricing models have evolved, and the issues confronted during that evolution might usefully be reviewed and mined for potential lessons for the development of online publishing and distribution pricing and business models.

5.2.3 The economics of online scholarly communication

The economic implications of the special characteristics of information have been explored in the general economic literature and are reasonably well known, but their implications for the emergence of new industrial structures and new business models are only now beginning to be worked through. Nevertheless, there is an increasing number of explorations of the nature and operation of emerging online information businesses – including, for example, Whinston, Stahl and Choi on the economics of e-business;[188] Arthur on the impacts of increasing returns on industry structure and corporate strategy;[189] Quah and Coyle on the characteristics and nature of competition in the weightless world;[190] Yoffie on competing in the age of digital convergence;[191] Shapiro and Varian,[192] Tapscott et al.,[193] Leebaert et al.,[194] Tapscott, Lowy and Ticoll,[195] Negroponte,[196] Tapscott,[197] etc. on the rules of information-based businesses and doing business in the digital age; and Glazer and Moody and Walsh on valuing information as a business asset.[198]

These could be explored in order to develop possible alternative models for the online publication and distribution of scholarly content – approaches which take into account both the unique economic characteristics of scholarly content and the emerging economics of online businesses, and take the form of detailed studies of the economics of alternative online electronic systems.

5.2.4 Institutional incentives

By tying promotion, pay, tenure, research funding, and other basic rewards to publication in a few, key, refereed journals in each field, universities and research institutions have created a dysfunctional system of incentives. The print journal publishing system has evolved into a mechanism for the development of CVs, rather than one for the communication and dissemination of ideas. An important area for future work is to address this problem.

One approach might be to undertake an analysis to develop, and through consultation refine, a set of performance indicators that would be acceptable to universities and research institutions *and* be in line with the goals of cost-effective dissemination without generating the dysfunctional consequences that plague those currently used. These could be trialed, and old system–new system indicators compared to ensure that key performance measures are both meaningful and effective.

Obviously, there are already significant changes underway in research performance measurement, especially in shifting the focus towards output-based indicators.[199] Nevertheless, there is a need to move further and faster in reforming incentives, and a need to take a more holistic, systems perspective on performance indicators and incentives than has been the case to date.

5.2.5 Scholarly communication system statistics

A recurring theme during research for this discussion paper has been the lack of sometimes quite basic data. Many have commented on the irony of the situation – of an information industry with very little information about itself.

Libraries: The library community does not have a particularly good handle on its own costs, or standard approaches to data collection on holdings, expenditures, staffing, etc. All too often judgements are made, rather than decisions, because of a lack of information. Benchmarking library and related functions is still difficult, and so little is known about the real value of assets that decisions about how much it is worth spending on their upkeep and preservation are imprecise at best.

Moreover, the lack of holistic costing has the potential to distort the market signals and create incentives with potentially negative effects. For example, what is included in university library budgets varies from institution to institution, but it is becoming more common for a significant proportion of IT costs to be sheeted home to the library while building infrastructure costs are not. This could lead to a preference for the maintenance of the print paradigm (print, shelves and buildings) over the electronic paradigm, even though the former's total costs may be higher.

Publishing: Despite the fact that the publishing industry is a major, global industry operating in the 'new economy' surprisingly little industry data are collected. Financial information is less extensive than in many other industries, because a relatively high proportion of publishing companies are private, rather than publicly listed. Many publishers and book sellers are interested in sales revenue and units sold (books), while others in the scholarly communication product system are more interested in titles produced. This has led to the collection of a mixture of cross-cutting and sometimes overlapping data, rather than to the collection of a coherent set of data which provide a complete picture of the industry.

There is, in short, a clear need for better statistics throughout the system, and given the increasing importance of the scholarly communication system in the emerging knowledge economy, it is becoming increasingly important that this need be addressed. Notwithstanding a number of international statistical initiatives,[200] there is scope for Australia to contribute to the development of both institutional and industry data definitions and collections.

5.3 Scholarly communication in transition

This discussion paper takes stock of where scholarly communication is, how it got there and how it operates, and it explores the nature of the 'crisis' in scholarly communication. But the scholarly communication system is not static. Indeed, it is undergoing profound change. To somewhat oversimplify it, the scholarly communication system is in the relatively early stages of a transition from print publishing to online communication and dissemination. A transition as fundamental as that facing any industry as we move into

the knowledge economy era and go online. And this transition comes on top of the 'crisis' in prices.

While in the long run online communication, publication and dissemination may provide the basis for a solution to the 'crisis', in the short term it is simply exacerbating it. Players throughout the scholarly communication product system, especially in publishing and distribution, must develop new skills and new organisational competencies suitable for the online environment, implement new procedures and practices, develop new business models and build and/or call into being an online scholarly communication infrastructure; while at the same time maintaining the existing print paradigm.

Australia is relatively well advanced in terms of adopting the online publishing and distribution paradigm, with some institutions going entirely electronic wherever possible for journal access, and abandoning their print journal collections. Other institutions are slower to change, with their clients clinging to the print paradigm, and they face additional hardship because they are trying to operate a dual mode (print *and* online) system, with all the additional overhead costs that that implies.

It important to realise that there are significant infrastructural and transitional costs involved in moving from the print to the online paradigm – costs that Australia's universities, research institutes and research libraries are finding extremely difficult to bear. Case studies of organisational change, analysing the transition from print to online access would shed light on transitional issues and provide invaluable information for Australian universities and research institutions facing the transition.[201]

5.4 The 'Crisis'

The 'crisis' in scholarly publishing and the challenge of electronic publishing are typical of technological change. The first reaction to technological opportunity is almost always to automate what one is currently doing. But it is rarely the real answer.

The pay off from new technological opportunities typically comes when one uses the technology to do things differently and/or do new things. It is unlikely that simply publishing journals electronically is the answer. The challenge is to work out what to do differently and what new things to do in order to facilitate the cost-effective communication and dissemination of ideas.

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Appendix I Notes on Publishers

This appendix contains a number of brief notes on some of the major publishers operating in the scholarly communication product system.

Commercial publishers

There is a number of major commercial publishers of scholarly content. Space does not permit a full review, but brief details on a few of the majors are provided to indicate something of the nature and scale of their activities. These summaries are derived from company annual reports, corporate and financial reports, exchange listings and filings, and a variety of financial information sources. They are listed alphabetically.

Academic Press (Harcourt Group): is a part of the Harcourt Group, which earned revenues of $US 581 million from its schools publishing activities in 1999 and a further $US 366 million from higher education. Over the last 5 years Harcourt Group revenues from publishing activities have grown at a compound annual 12 per cent. Total group revenue exceeded $US 2 billion in 1999. Worldwide scientific, technical and medical publishing revenues, of which Academic Press accounted for a major share, reached almost $US 700 million.[202]

Blackwell's Publishing: was founded in 1926 and claims to be the world's largest independent, privately owned academic publisher of books, journals and educational software. Blackwell's stresses the quality of its publications, saying: "Our first task is to seek out and select only the best, to keep the numbers of our titles low and their quality high. We aim to publish no more than 250 new titles a year and maintain a backlist of about 2,000 titles. Our journals and software are subject to the most rigorous peer and user reviews prior to publication."[203] These statements make their core business strategy clear.

Houghton Mifflin Company: operates in the education publishing market through Houghton's school division and the company's three principal subsidiaries: McDougal Littell, Great Source Education and The Riverside Publishing Company. Their education publishing includes textbooks and instructional materials, tests for measuring achievement and aptitude, clinical and special needs testing products, computer-assisted and computer-managed instructional programs. The company also operates a trade and reference division, Houghton Mifflin Interactive Corporation and Computer Adaptive Technologies, Inc.; publishes fiction and non-fiction, dictionaries and other reference works; and develops and sells multimedia consumer products. Houghton Mifflin has a United States market capitalisation of around $US 1.25 billion. On sales of $US 920 million during 1999 the company realised earnings (EBITDA) of $US 202 million, with an after tax profit margin of 5 per cent.

Information Holdings, Inc: publishing focuses on providing essential information to professional and academic markets. The company operates in the scientific, technical

and medical (STM) and professional market through CRC Press and in the intellectual property market through MicroPatent. CRC Press is a mid-sized STM and professional publisher with leading positions in several niche markets. In August 1998, CRC Press acquired the mathematics/statistics and chemical product lines of Chapman and Hall from Wolters Kluwer. MicroPatent is a source of intellectual property information products and services. Its patent and trademark databases are used extensively by legal and research professionals and corporations. In January 1999, MicroPatent acquired Optipat, which provides print and internet-delivered patent information to the legal and corporate markets. Information Holdings has a United States market capitalisation of almost $US 785 million. On 1999 sales of $US 59 million, the company realised earnings (EBITDA) of $US 12.2 million, with a profit margin of 10.2 per cent.

John Wiley & Sons: is a publisher of print and electronic products, specialising in scientific, technical, professional, medical books and journals and educational materials. Wiley recently acquired Jossey-Bass publishing. Earnings over the last year reflect strong performance from their subscription journals business. In 1997, 47 per cent of Wiley's revenue came from science, technology and medical publishing activities, professional accounted for 28 per cent and educational for 25 per cent. Wiley targets high return science and professional publishing and has a particular focus on 'continuity products' (material requiring regular updates). Wiley has a United States market capitalisation of almost $US 1 billion. Sales amounted to $US 570 million, with earnings (EBITDA) of $US 100 million and a profit margin of 8.9 per cent in the year to April 1999. Accounts and royalties payable amounted to $US 36.8 million for 1998, from total revenues $US 467 million.

McGraw-Hill: provides information products and services to the business, professional and educational markets around the world. The Company's finance and business group publishes McGraw-Hill's business and reference books, provides new media products such as *Business Week Online*, and provides the Standard & Poor's financial publications. The education group provides high school and post-secondary market textbooks and electronic materials. The company's construction information group provides *Construction Online*, a source of project news, product information, industry analysis and editorial coverage for design and construction professionals. McGraw-Hill healthcare information publications include *Healthcare Informatics, Hospital Practice and The Physician* and *Sportsmedicine*. McGraw-Hill's broadcasting group owns and operates four television stations. The aerospace and defence group provides a number of publications, including *Business and Commercial Aviation*. McGraw-Hill has a United States market capitalisation of more than $US 9 billion. On sales of $US 4 billion, the company realised earnings (EBITDA) of $US 940 million last year.

Reed Elsevier: Reed Elsevier’s businesses employ around 26,000 people. Combined turnover reached almost £3.2 billion in 1998. Reed Elsevier’s strategy is to concentrate on publishing and information provision through international businesses with strong positions in large and growing markets. As well as maintaining its leading position in the scientific information market, Reed Elsevier is developing its interests in professional and business markets, through both organic growth and acquisitions.

- *Scientific publications* realised £622 million or 20 per cent of total turnover and employed 3,500 people. Businesses in the Scientific segment publish more than 1,200 journals worldwide with more than 150,000 new research articles published each year in the physical, life, social and medical sciences, and operate an international network of medical communications services.
- *Professional publications* include LEXIS-NEXIS, one of the largest databases in the world with over 10 terebytes of information providing access to more than 24,000 sources. Professional publication realised £1,154 million or 36 per cent of total turnover and employed more than 11,000 people word wide.
- *Business publications* realised £1,387 million or 44 per cent of total turnover and employed 11,300 people worldwide. Combined, Reed Business, Cahners Business and Elsevier Business publications include a wide range of industry journals, magazines and newsletters, as well as business directories (including Kelley's and Kompass).[204]

Table A1.1 Reed-Elsevier Business Activities, 1998

Business	*Employees No*	*Turnover £m*	*Profit £m*	*Operating Margin %*
Scientific	3,500	622	223	35.9
- Elsevier Science	-	513	-	-
- Medical Business	-	109	-	-
Professional	11,100	1,154	330	28.6
- LEXIS-NEXIS	-	741	-	-
- Legal	-	207	-	-
- Educational	-	206	-	-
Business	11,300	1,387	260	18.7
- Cahners	-	455	-	-
- Reed Business	-	275	-	-
- Elsevier Business	-	210	-	-
- Cahners Travel	-	76	-	-
- OAG Worldwide	-	90	-	-
- Reed Exhibitions	-	274	-	-
- Other	-	7	-	-
TOTAL	*26,100*	*3,163*	*813*	*25.7*

Source: Reed Elsevier (1998) *Annual Report - 1998*, Reed Elsevier. http://www.reed-elsevier.com

For 1998, the Reed-Elsevier group reported cost of sales (production) of £1.1 billion, distribution and selling costs of £714 million and administrative expenses of £992 million in 1998. They earned a pre-tax profit of £773 million, and enjoyed an operating margin of more than 25 per cent.

Like other large commercial publishers the Reed Elsevier group includes a number of well known publishing 'brands'. Reed Elsevier's business units include:

Elsevier Science
The Lancet
Editions Scientifiques et Medicales Elsevier
Editions Du Juris-Classeur
Lexis-Nexis
Shepard's
Reed Exhibition Companies
Cahners Travel Group
OAG Online
Pan European Publishing Company
Excerpta Medica
Springhouse Corporation
Butterworths
Staempfli Verlag
Martindale Hubbell
Reed Educational and Professional Publishing
Cahners Business Information
Reed Business Information
Elsevier Business Information

Many of these are significant operations in their own right. For example, Cahners Business Information claims more than 6.5 million subscribers and a database of 9.5 million professional. Cahners claims a reach larger than the combined United States circulation of The *Wall Street Journal, Fortune, Forbes* and *Business Week.* Cahners claims: to produce 62,000 editorial pages each year; have 1,225 journalists, editors and reporters on staff, and operate 48 news bureaux around the world. Cahners produces 3 dailies, 11 weeklies, 8 bi-monthlies, 94 monthlies, 14 quarterlies, 50 annuals, and 2,536 issues per year, as well as operating 140 specialized web sites with more than 6 million page impressions per month.[205]

Thomson: recently acquired specialist legal publisher West Group, and operates with it as its legal and regulatory group in the legal publishing field, Thomson Learning as a seller of textbooks, Thomson Financial as a provider of financial information, and Thomson Scientific, Reference and Healthcare as a provider of information to researchers and other professionals. Thomson also controls Derwent, specialist patent publishers, and includes ISI and the Gale Group. ISI's Web of Science is a widely used set of citations indexes, including: Science Citation Index Expanded (SCIE) for which the 1999 annual subscription price in Australia was $US 58,000, the Social Science Citation Index (SSCI) for which the 1999 subscription price was $US 25,300, and the Arts and Humanities Citation Index (AHCI) for which ISI charged a subscription of just under $US 20,000.

Wolters Kluwer: focuses on legal, business and health publications, with a lesser focus on educational publication (mainly for schools). Strong performance in print publishing has been enhanced by electronic publishing revenues over EUR 550 million in 1998. Net sales in 1999 reached EUR 3.1 billion, up from just EUR 924 million in 1990, generating EUR 781 million in income. One of the drivers of the expansion of activity was the acquisition of Plenum Publishing during 1998. Wolters Kluwer has recently committed an additional EUR 250 million to its internet strategy over the next three years, and has realigned its businesses into five operational clusters to help focus attention on specific customer groups. The new organisation structure aims to facilitate a distinct branding, partnering, and e-business development strategy for each cluster.

- *Legal, Tax and Business* is now organised into 3 regional clusters, serving Europe, North America and Asia/Pacific. These will develop regional legal, tax, and

business portals for the professional communities that make up their collective subscriber bases. These portals will aggregate in one place all of the cluster's existing product offerings as well as new e-commerce activities and web-based businesses.

- *International Health and Science* will leverage its audience of healthcare professionals by creating an umbrella portal that will be a convenient point of access to the rich content, services, and software sources of the cluster. In addition, the cluster internet offerings under the umbrella will include websites targeted at specific professional groups (eg. nurses, pharmacists, etc.), those interested in specific diseases and medical specialties (eg. oncology, paediatrics, etc.), and journal sites in combination with medical societies.
- *Educational Publishing* will focus its development activities on online curriculum learning projects. Educational publishing subsidiaries include: Bohmann/Jugend und Volk, Manz Schulbuch Verlag, Wolters Plantyn, Kieser Verlag, Verlag H. Stam, Verlag Dr. Max Gehlen, Wolf Verlag, Müszaki Kiadó, Akadémiai Kiadó, EPN, Wolters-Noordhoff, Liber, Norstedts Ordbok, and Stanley Thornes Publishers.

There are a number of other major players in scholarly publication, and many thousands of smaller, niche publishers.

Institutional publishers

Most Universities and many research schools operate publication arms. There are far too many to present a full picture, but a few brief reviews are presented below to give some sense of their activities.

Cambridge University Press (CUP): Over the last 25 years CUP has experienced significant growth and development. The range of publishing now covers virtually every educational subject seriously studied in the English-speaking world and a growing range of books for professionals in medicine, law, engineering, and computer science. There are now more than 20,000 books in print, along with journals, maps, wall-charts, slides, CD-ROMS, and an increasing number of on-line publications. CUP seeks to attract the best authors and to publish the best work in the English language worldwide; it currently has over 24,000 authors in 108 countries, including well over 8,000 in the USA (over 1,000 in California alone), over 1,300 in Australia, and over 100 each in countries as various as Japan, Russia, South Africa, Spain and Israel. CUP distributes through its own network around the world. In addition to the North American Branch there are branches in Australia, Africa, Brazil, and Spain. CUP's websites were visited by two and a half million people worldwide in 1998.[206]

Harvard Business School Press: Harvard Business School Press seeks to improve the practice of management and its impact on a changing world. It is committed to seeking out, nurturing, and publishing significant ideas that will have an impact on business for a decade or more, and aims to be the publisher of choice for authors and content experts

with important management ideas and a desire to improve the practice of management worldwide.[207]

John Hopkins University Press and Project MUSE: The Johns Hopkins University Press (JHUP) is one of the United State's oldest and largest university presses. It publishes more than 170 books each year and 52 scholarly journals. JHUP publications focus on such disciplines as literary studies, classics, history, economics, political science, and the history of science and medicine. Project MUSE was launched in 1995 as a joint initiative of the Johns Hopkins University Press and the Milton S. Eisenhower Library at Johns Hopkins University. The aim was to offer the full text of JHUP scholarly journals via the worldwide web. In 1999, MUSE published online 46 JHUP titles in the humanities, social sciences and mathematics. The basic aim of readily accessible, low price online publication achieved, Project MUSE is now expanding. During 2000 Project MUSE will add over 60 titles from other not-for-profit scholarly publishers, so that there will be 113 titles available. Other participating publishers include the university presses of: Carnegie Mellon, Duke, Indiana, MIT, Oxford, Pennsylvania State, Hawaii, Texas, West Virginia and Wisconsin. These will extend the disciplinary coverage to include: African-American literature, Asian culture and history, gender studies, medieval studies, higher education, health policy and political science. There are now more than 700 institutional subscribers (no individual subscriptions are allowed). Access to the full database during 2000 costs $US 8,000 for larger academic and corporate institutions, and there are various packages and discounts available for smaller users.[208]

MIT Press: The MIT Press is the only university press in the United States whose list is based in science and technology. It publishes about 200 new books a year and over 40 journals. MIT Press started in 1926 when the physicist Max Born visited the Massachusetts Institute of Technology to deliver a set of lectures on Problems of Atomic Dynamics. MIT published the lectures under its own imprint, and that book is numbered 1 in the press's archives. With cutbacks in education in the 1970s MIT Press developed a strategy of focusing on a few key areas and publishing in depth in those areas. The initial core consisted of architecture, computer science and artificial intelligence, economics, and the emerging discipline of cognitive science. MIT Press produced book 5,500 to September 1998. It now claims to sell a higher proportion of its products outside the United States than any other US-based university press.[209]

Oxford University Press (OUP): claims to be the world's largest university press, publishing over 4,000 new titles a year. Its publishing program includes scholarly works in all academic disciplines, Bibles, music, school and college textbooks, children's books, materials for teaching English as a foreign language, business books, dictionaries and reference books, and journals. Most of these publications are produced by the two major publishing centres in Oxford and New York, but there are additional publishing programs in many countries around the world.[210]

Melbourne University Press (MUP): Melbourne University Press was founded in 1922 by a statute of the University of Melbourne to sell books and stationery to

students. It soon developed its own publishing program and later established its own printing facilities. MUP's first publication, in 1922, was a duplicated set of notes from the Physics School, then known as Natural Philosophy. As Practical Physics, Part One, these notes remained in print until 1947. The first 'real' book was Myra Willard's History of the White Australia Policy, published in 1923 with a first print run of 600 copies. MUP now publishes about 50 new books and electronic products each year in a wide range of subject areas and disciplines, and maintains a backlist of some 200 titles. Today the Press is a semi-autonomous department of the University but receives no direct funding. While remaining self-sufficient, it aims to provide a publishing and book selling service to both the academic and the wider community.[211]

University of Queensland Press (UQP): UQP has focused its scholarly monograph and journals publishing in the areas of Australian Literature, Australian Studies, Cultural and Media Studies and Australian History and Politics. As a regional publisher UQP has a special interest in tropical and subtropical Australia and the Pacific region. UQP has published many contemporary Australian poets, a number of Australian novelists, and has been a leader in developing the writing of Aboriginals and Torres Strait Islanders. UQP published 23 books in 1999 and produces 6 journal titles, for which institutional subscriptions range between $20 and $75.

Membership-based association publishers

There are hundreds, if not thousands, of associations that publish journals on a scale ranging from the globally significant to very local and modest. A number also offer avenues for monograph and textbook publication. Major association publishers of scholarly journals and books include the following.

ACM (Association for Computing Machinery): Founded in 1947, the ACM was the world's first educational and scientific computing society. Today ACM has over 80,000 members among computing professionals and students worldwide. ACM publishes, distributes and archives original research and first hand perspectives from the world's leading thinkers in computing and information technologies. ACM offers over two dozen publications for computing professionals. The ACM Press books program covers a broad spectrum of interests in computer science and engineering. The ACM recently launched a six-year archive of journals, magazines, and conference proceedings as well as current issues of magazines and journals online. ACM is also recognised for its published curricula recommendations, for colleges, universities and schools preparing students for advanced education in the information sciences and technologies.

- *ACM magazines* include: Communications of the ACM, netWorker, Mobile Networks and Applications (MONET), Journal of Graphics Tools, Journal of Experimental Algorithmics (JEA), Distributed Computing, interactions, StandardView, Multimedia Systems, Computing Surveys, Computing Reviews, Journal of the ACM, and Wireless Networks.
- *ACM journals* include eleven separate archival publications which serve as primary sources of technical material on the mix of research and practice in: Computer-

Human Interaction, Computer Systems, Database Systems, Design Automation for Electronic Systems, Graphics, Information Systems, Mathematical Software, Modelling and Computer Simulation, Networking, Programming Languages and Systems, and Software Engineering and Methodology.

- *ACM Press's* books program is a collaborative effort between ACM and Addison Wesley Longman, which seeks to publish and distribute a broad range of new books in computer science and engineering.[212]

The ACM charges very reasonable prices for access to all their publications online, suggesting that it is in the not-for-profit mould.

ACS (American Chemical Society) & CAS (Chemical Abstracts Service): ACS was chartered by the United States Congress in 1876 and claims to be the world's largest scientific society, with 159,000 members. The ACS seeks to advance knowledge and research through scholarly publishing, conferences, providing information resources for education and business, and professional development activities. ACS publications aim to provide members and the worldwide scientific community with a collection of information products and services. More than 30 magazines and peer-reviewed journals are published or co-published, with approximately 140,000 pages of research material produced annually in print and online. Publishing is the major revenue-generating activity in what is essentially a not-for-profit association. ACS serials pricing reflects this. Of its 28 listed serials print subscriptions plus an online site license for institutions outside North America range from $US 5,588 for *The Journal of Physical Chemistry*, to $US 683 for the *Accounts of Chemical Research*.[213]

AEA (American Economic Association): has around 21,000 members. AEA publishes *American Economic Review*, *Journal of Economic Perspectives*, and *Journal of Economic Literature* which are sold as a bundle for $US 140 per annum for libraries. All are produced quarterly. Subscription sales account for just over 19 per cent of AEA's revenue, or approximately $US 750,000. AEA's *Index* and *EconLit* electronic indexes of English language economic literature are sold separately and generate around 19 per cent of the Association's revenue. Journal publication generates around 5,000 pages a year and involves handling around 1,600 referees' reports.[214]

AIP (American Institute of Physics): is a not-for-profit membership corporation chartered in 1931 for the purpose of promoting the advancement and diffusion of the knowledge of physics and its application to human welfare. Its mission is to serve the sciences of physics and astronomy by serving the Societies, by serving individual scientists, and by serving students and the general public. AIP has over 120,000 individual members. AIP is a leading publisher of magazines and journals, including translations of research originally published in Russian. AIP publishes and distributes print and electronic journals of original research, reviews, and translations; conference proceedings, magazines; and electronic databases. Books under the AIP press imprint are published by Springer-Verlag through a licensing agreement. AIP publishes 67 journals. AIP's Conference Proceedings series offers a valuable archive of conferences, symposia, and workshops. Selected Proceedings' papers are included in SPIN™ and

other major bibliographic databases, providing visibility to the larger scientific community. AIP has published almost 460 volumes since 1970 – 40 in 1998. AIP's Translation Program produces virtually simultaneous English versions, in print and online, of eight Russian journals.[215] In 1998, AIP earned almost $US 52 million from its publishing activities – 79 per cent of its total annual revenues. Publishing expenses were reported to be $US 44.4 million for 1998, implying a 16 per cent margin.

IEEE (Institute of Electrical and Electronics Engineers): seeks to promote the creation, sharing and application of knowledge about electrical and information technologies. The IEEE is a membership-based and membership-driven organisation. Its has 900 staff and some 350,000 members, of whom 60 per cent or more are in the United States. The IEEE claims to be the 9th largest science and technology publisher in the world, producing around 30 per cent of the world literature in the field.[216] Although the IEEE is membership-based publishing provides approximately 50 per cent of its revenue, with membership fees providing around 20 per cent and conferences and other activities the remaining 30 per cent. A comprehensive collection of IEEE journals, conference proceedings and standards is available, linked through INSPEC. An all periodicals package is available at a package price to institutional clients. Average IEEE journal subscription price is around $US 300 or $US 200 each in the all periodicals package.

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Appendix II Scholarly Publishers

Following are membership lists from three of the major publishers' associations for publishers active in scholarly publication. They are presented in order to give some impression of the number of publishers operating around the world.

International Association of Scientific, Technical & Medical Publishers

The principal international trade association for scholarly publishers, although its membership is not fully representative of university press and small society publishers.

Table A2.1 IASTMP Members

Name of Company	City	Country
Active Press	**Burlington**	**US**
Alfaomega Grupo Editor S.A.	**Mexico D.F.**	**MX**
Alfaomega Libros S.A.	Buenos Aires	ARG
Alfaomega Grupo Editor S.A.	Bogota	COL
Alfaomega Libros S.A.	Santiago	CI
American Chemical Society	**Washington, DC**	**US**
Chemical Abstracts Service	Ohio	US
American Psychological Assoc.	**Washington, DC**	**US**
American Institute of Physics	**Melville**	**US**
American Medical Association	**Chicago**	**US**
American Medical Association	Parsippany, NJ	US
Annual Reviews	**Palo Alto**	**US**
Arnold	**London**	**UK**
Baifukan Co. Ltd.	**Tokyo**	**JP**
Begell House, Inc.	**New York**	**US**
Bell+Howell	**Ann Arbor**	**US**
John Benjamins Publishing Co.	**Amsterdam**	**NL**
Ingenta / BIDS	**Bath**	**UK**
Ingenta Ltd	Oxford	UK
BIOSIS Philadelphia	**US**	
BIOSIS Bucks	UK	
BIOSIS U.K.	York	UK
BIOS Scientific Publ. Ltd.	**Oxford**	**UK**
BIS Books Information	**Mexico City**	**MX**
BIS/Argentina	Buenos Aires	ARG
BIS/Chile	Santiago de Chile	CI
BIS/Costa Rica	San Jose	CR
BIS/Panama	Cd. de Panama	PA
Blackwell's	**Oxford**	**UK**
Blackwell Science	**Oxford**	**UK**
Blackwell Science Asia Pty. Ltd.	Carlton	AUS
Blackwell Science Inc.	Malden, MA	US
Blackwell Wissenschafts Verlag	Berlin	DE
Blackwell Medcorn Ltd.	Hong Kong	HK
Munksgaard International Publ.	Copenhagen	DK

Name of Company	City	Country
BMJ Publishing Group	**London**	**UK**
Brill Academic Publishers	**Leiden**	**NL**
VSP-International Science Publ.	Zeist	NL
CABI Publishing	**Wallingford**	**UK**
Cassis Publishing Company Ltd.	**Abingdon, Oxfordshire**	**UK**
CatchWord	**Abingdon, Oxfordshire**	**UK**
CatchWord North America	New York, NY	US
CatchWord North America	Cambridge, MA	US
The Charlesworth Group	**Huddersfield**	**UK**
Maney Publishing	Leeds	UK
CRC Press	**Boca Raton**	**US**
Cambridge University Press	**Cambridge**	**UK**
Cambridge University Press NY	New York	US
Cambridge University Press	Stanford	US
Cambridge University Press	Singapore	SI
F.A. Davis Company	**Philadelphia, PA**	**US**
Marcel Dekker, Inc.	**New York, NY**	**US**
Marcel Dekker AG	Basel	CH
EBSCO Information Services	**Birmingham, AL**	**US**
EBSCO Subscription Services	Rijsenhout	NL
EBSCO Publishing - Boston	Ipswich, MA	US
EDP Sciences	**Les Ulis**	**FR**
Edwards Brothers, Inc.	**Ann Arbor, MI**	**US**
Elsevier Science	**Amsterdam**	**NL**
Adonis B.V.	Amsterdam	NL
Butterworth-Heinemann	Oxford	UK
Butterworth Heinemann	Woburn	US
Editora Campus Ltda.	Rio de Janeiro	BR
Cell Press	Cambridge, MA	US
Reed Elsevier	Amsterdam	NL
Editions Scientifiques et Medi	Paris	FR
Elsevier Science - Korea	Seoul	KOR
Elsevier Science Ireland Ltd.	Shannon	IR
Elsevier Science Japan	Tokyo	JP
Elsevier Science Ltd.	Kidlington/Oxford	UK
Elsevier Science S.A.	Lausanne	CH
Elsevier Science Inc.	New York, NY	US
Reed Elsevier	New Providence, NJ	US
K.G. Saur GmbH & Co. KG	Munich	DE
Society for Endocrinology	**Bradley Stoke**	**UK**
Futura Publishing Company	**Armonk, NY**	**US**
Van Gorcum & Company BV	**Assen**	**NL**
Walter de Gruyter & Co.	**Berlin**	**DE**
Walter de Gruyter Inc.	Hawthorne	US
Carl Hanser Verlag	**Munich**	**DE**
Harcourt Brace & Company	**Chestnut Hill, MA**	**US**
Academic Press Boston	Burlington, MA	US
Academic Press Ltd.	London	UK
Academic Press San Diego	San Diego, CA	US
Harcourt Brace & Co. Ltd	Edinburgh	UK
Harcourt Brace & Company	Toronto	CAN
Harcourt Brace & Company	Tokyo	JP
Harcourt Brace & Company	Marrickville	AUS
Harcourt Brace Publishers	London	UK
W.B. Saunders Company	Philadelphia, PA	US

Name of Company	City	Country
Otto Harrassowitz, Publishers	**Wiesbaden**	**DE**
Havas	**Paris**	**FR**
Dalloz	Paris	FR
Dunod Editeur	Paris	FR
Masson SPA	Milan	IT
Masson S.A.	Barcelona	ES
Masson Editeur	Paris	FR
The Haworth Press Inc.	**New York**	**US**
HighWire Press	**Stanford, CA**	**US**
Verlag Hans Huber AG	**Bern**	**CH**
Hogrefe-Verlag GmbH & Co. KG	**Göttingen**	**DE**
ICSTI, Int.Council Scien.Tech. Information	**Paris**	**FR**
European Patent Office Direct	Rijswijk	NL
ICSTI	Beverly Farms, MA	US
US National Library of Medicine	**Bethesda, MD**	**US**
IEEE	**Piscataway, NJ**	**US**
Igaku-Shoin Ltd.	**Tokyo**	**JP**
LWW Igaku-Shoin Ltd.	Tokyo	JP
Igaku-Shoin Medical Publishers	New York, NY	US
Medical Sciences International	Tokyo	JP
Institution of Electrical Engineers	**Stevenage**	**UK**
Editions INSERM	**Paris**	**FR**
Institute of Physics (IOP) Publishing Ltd.	**Bristol**	**UK**
IOP Publishing	Philadelphia, PA	US
ISI - Institute for Scientific Information	Philadelphia, PA	US
Derwent Information Limited	London	UK
ISI - Institute for Scientific Information	Uxbridge	UK
The Thomson Corporation	London	UK
Japan Scientific Societies Press (JSSP)	Tokyo	JP
Kinokuniya Company Ltd.	**Tokyo**	**JP**
Kinokunya Publ. Service	London	UK
Kinokuniya Publ. Service	New York	US
Kluwer Academic Publishers	**Dordrecht**	**NL**
Adis International Ltd.	Mairangi Bay Auckland	NZ
Adis International Limited	Chester	UK
Aspen Publishers, Inc.	Gaithersburg	US
Kluwer Academic/Plenum Publ.	New York	US
Kluwer Academic Publishers	Dordrecht	NL
Kluwer Law International	The Hague	NL
Kluwer Academic Publishers	Norwell	US
Kluwer B.V.	Deventer	NL
Kluwer Fidura	Best	NL
Kluwer Academic/Plenum Publ.	London	UK
Lippincott Williams & Wilkins	Baltimore	US
Lippincott Williams & Wilkins	Baltimore	US
Lippincott Williams & Wilkins	London	UK
Lippincott Williams & Wilkins	Philadelphia	US
Lippincott Williams& Wilkins	New York	US
Lippincott Williams & Wilkins	Hong Kong	HK
Wolters Kluwer Int. Healthcare	Philadelphia	US
Wolters Kluwer België N.V.	Diegem (Brussel)	BE
Wolters Kluwer Nederland B.V.	Deventer	NL
Wolters Kluwer Ovid Tech.	New York	US
Wolters Kluwer N.V.	Amsterdam	NL
Lucius et Lucius	**Stuttgart**	**DE**

Name of Company	City	Country
Macmillan Press Ltd.	**Basingstoke**	**UK**
Grove's Dictionaries Inc.	New York, NY	US
Macmillan Reference Ltd	London	UK
Nature, Macmillan Magazines	London	UK
Nature Publishing Group	New York, NY	US
Editorial El Manual Moderno SA	**Mexico City, DF**	**MX**
Editorial El Manual Moderno	Santafe de Bogota	COL
Marcombo SA, de Boixareu	**Barcelona**	**ES**
Maruzen Co. Ltd.	**Tokyo**	**JP**
Maruzen Co. Ltd. London Office	London	UK
Maruzen International Co., Ltd	Weehawken	US
The McGraw-Hill Companies	**New York, NY**	**US**
McGraw-Hill Book Company	Roseville East	AUS
McGraw-Hill Interamericana	Rio Piedras	PR
McGraw-Hill Libri Italia, srl	Milan	IT
McGraw-Hill Mexico	Mexico City	MX
McGraw-Hill/Interamericana	Aravaca Madrid	ES
McGraw-Hill Book Company	Jurong	SI
McGraw-Hill Publishing Company	Maidenhead, Berkshire	UK
McGraw-Hill Ryerson, Ltd.	Whitby	CAN
Medpharm GmbH Scientific	**Stuttgart**	**DE**
Nankodo Co., Ltd.	**Tokyo**	**JP**
National Academy of Sciences	**Washington DC**	**US**
The New England Journal of Medicine	**Waltham**	**US**
NSPA (Japanese PA)	**Tokyo**	**JP**
OCLC	**Dublin, Ohio**	**US**
Ohmsha Ltd.	**Tokyo**	**JP**
Oxford University Press	**Oxford**	**UK**
Editorial Médica Panamericana	**Buenos Aires**	**ARG**
Editorial Médica Panamericana	Mexico	MX
Editorial Médica Panamericana	Madrid	ES
Pearson Education Ltd	**Harlow, Essex**	**UK**
Pearson Education	Upper Saddle River	US
Prentice-Hall of India PTE	New Delhi	IN
Professional Engineering Publ.	London	UK
Professional Engineering Publ.	Bury St. Edmunds	UK
Pharmaceutical Press	**London**	**UK**
Polish Scientific Publishers	**Warsaw**	**POL**
Kossuth Publishing Corp.	Budapest	HU
Law Publishers PWN	Warszawa	POL
Polish Scientific Publishers	Del Mar, CA	US
Polish Scientific Publishers	Krakow	POL
Polish Scientific Publishers	Marlow	UK
School Publishers PWN	Warszawa	POL
Vulcan Media	Wroclaw	POL
Wydawnictwo Lekarskie PZWL	Warsaw	POL
Portland Press, Ltd.	**London**	**UK**
Publishers Communication Group	**Cambridge**	**US**
Rowecom	**Westwood**	**US**
The Royal Society of Chemistry	**Cambridge**	**UK**
The Royal Society of Chemistry	London	UK
Sage Publications Ltd.	**London**	**UK**
Verlag Dr. Otto Schmidt KG	**Cologne**	**DE**
Scientific American	**New York, NY**	**US**

Name of Company	City	Country
W.H. Freeman at Macmillan Press	Hampshire	UK
SilverPlatter Information Inc.	**Norwood, MA**	**US**
SilverPlatter B.V.	Amsterdam	NL
SilverPlatter Information GmbH	Berlin	DE
SilverPlatter Information Ltd.	London	UK
Spektrum Verlag	**Heidelberg**	**DE**
Spektrum Academic Publishers	Oxford	UK
Springer-Verlag GmbH & Co. KG	**Heidelberg and Berlin**	**DE**
Birkhauser Verlag AG	Basel	CH
Springer-Verlag Iberica, S.A.	Barcelona	ES
Springer-Verlag GmbH & Co. KG	Berlin	DE
Springer-Verlag Hong Kong Ltd.	Hong Kong	HK
Springer-Verlag London Ltd.	Godalming	UK
Springer-Verlag KG	Vienna	AU
Springer-Verlag New York Inc.	New York	US
Springer Publishing Co.	**New York**	**US**
The Stationery Office	**London**	**UK**
Studentlitteratur AB	**Lund**	**SW**
Swets & Zeitlinger bv	Lisse	NL
Turpin Distribution Services	Letchworth	UK
Wennergren-Williams	Solna	SW
Taylor & Francis Group plc	**London**	**UK**
Garland Publishing	New York	US
Psychology Press	East Sussex	UK
Taylor & Francis Group Inc	Philadelphia, PA	US
Taylor & Francis	Stockholm	SW
Taylor& Francis AS	Oslo	NO
Technomic Publishing Co. Inc.	**Lancaster**	**US**
Technomic Publishing AG	Basel	CH
Thomas Telford Ltd	**London**	**UK**
B.G. Teubner GmbH	**Stuttgart**	**DE**
Georg Thieme Verlag KG	**Stuttgart**	**DE**
Hippokrates Verlag	Stuttgart	DE
Thieme New York	New York	US
Editorial Trillas, S.A.	**Mexico City**	**MX**
Universitetsforlaget	**Oslo**	**NO**
Urban & Fischer	**Munich**	**DE**
Urban & Fischer Verlag	Jena	DE
Friedr. Vieweg & Sohn	**Wiesbaden**	**DE**
Editions Vuibert	**Paris**	**FR**
John Wiley & Sons Inc.	**New York**	**US**
John Wiley & Sons Ltd.	Chichester	UK
John Wiley & Sons Ltd.	London	UK
Wiley-VCH Verlagsgesellschaft	Weinheim	DE
World Bank	**Washington, DC**	**US**
World Health Organization	**Geneva**	**CH**
World Health Organization	**Copenhagen**	**DK**
World Scientific Publ. Co. Pte.	**Singapore**	**SI**
World Scientific Publishing	London	UK
World Scientific Publishing Co.	River Edge	US
Zanichelli S.P.A. Editore	**Bologna**	**IT**
Casa Editrice Ambrosiana	Milan	IT
Loescher Editore	Turin	IT
Zanichelli Editore S.P.A.	Milan	IT

Note: Organisations in light type are subsidiaries of companies shown immediately above in bold.

Association of Learned Professional & Society Publishers (UK)

ALPSP is the trade association that represents commercial, university press and learned society publishers in the UK. Its members represent a mix of large and small, self-publishing and publishing via others.

Table A2.2 ALPSP Members

Alden Press
A-Mail - Dudley Jenkins List Broking
Arnold
JW Arrowsmith Ltd
ASLIB
Association of Applied Biologists
Beech Tree Publishing
Biochemical Society / Portland Press Ltd.
Blackwell Publishing Companies
Blackwell's Information Services
Barry Bracewell-Milnes
British Council
British Dental Association
British Ecological Society
British Editorial Society of Bone and Joint Surgery
British Geriatrics Society
British Institute of Non-Destructive Testing
British Institute of Radiology
British Library Publishing
British Medical Association
British Nursing Index Publications
British Occupational Hygiene Society
British Ornithological Union
British Psychological Society
British School at Rome
British Society for Immunology
British Society for Plant Pathology
British Trust for Ornithology
British Veterinary Association
CAB International
Cambridge Crystallographic Data Centre
Cambridge University Press
CatchWord
Charlesworth Group
Chartered Institute of Management Accountants
Clarke Associates
Company of Biologists
John Cox Associates
CRC Press UK LLC
Davenport Publishing Services
EBSCO Information Services
Edinburgh Mathematical Society
Elsevier Science
English Heritage
Faculty of Family Planning and Reproductive Health Care
Fauna and Flora International
Fingerprint Society

Forensic Science Society
Geological Society
Gray Publishing
Harcourt Health Sciences
Health Education Authority
Health Education Board for Scotland
Hydrographic Society
Incorporated Council of Law Reporting for England and Wales
ingenta
Institute of Acoustics
Institute of Biology
Institute of British Foundrymen
Institute of Food Science and Technology
Institute of Information Scientists
Institute of Marine Engineers
Institute of Materials
Institute of Mathematics and Its Applications
Institute of Measurement and Control
Institute of Petroleum
Institute of Physics and Engineering in Medicine
Institute of Physics Publishing
Institute of Psycho-Analysis
Institution of Chemical Engineers
Institution of Civil Engineers
Institution of Electrical Engineers
Institution of Mechanical Engineers/Professional Engineering Publishing
Interfisc Publishing
International Council for Science
International Glaciological Society
International Network for the Availability of Scientific Publications
International Union of Crystallography
International Water Association
Journal of Transport Economics and Policy
Journals of Reproduction and Fertility
Latimer Trend Group
Legal Information Resources Ltd
Brian Lewis Consultants Ltd
Henry Ling
London Mathematical Society
London School of Economics
London School of Hygiene and Tropical Medicine
M3D Consultancy
Maney Publishing
MCB University Press Ltd
Modern Humanities Research Association
Nature Publishing Group
Nautical Archaeology Society
NIR Publications
Novartis Foundation
Nuclear Technology Publishing
Nutrition Society
Di Owen Marketing
Organisation for Economic Cooperation and Development
Overseas Development Institute
Oxford University Press
Physiological Society
Pion Limited
Polestar Scientifica

Public Management & Policy Association
Publishers' Management Advisers
Pullinger Ltd
RAPRA Technology
RCP Consultants Ltd
Redhall Associates Ltd
Regional Studies Association
RoweCom Inc
Royal Anthropological Institute
Royal Astronomical Society
Royal College of General Practitioners
Royal College of Obstetricians and Gynaecologists
Royal College of Psychiatrists
Royal Commission on the Historical Monuments of England
Royal Geographical Society (with the Institute of British Geographers)
Royal Institute of International Affairs
Royal Irish Academy
Royal Pharmaceutical Society of Great Britain
Royal Philatelic Society London
Royal Society
Royal Society of Chemistry
Royal Society of Edinburgh
Royal Society of Medicine
Royal Statistical Society
Royal Swedish Academy of Sciences
Royal Town Planning Institute
Sage Publications
Salix Publishing Limited
Science Reviews
Society for Endocrinology
Society for General Microbiology
Society for Underwater Technology
Society of Chemical Industry
Society of Dyers and Colourists
Society of Freelance Editors and Proofreaders
Society of Indexers
Peter Sowden
Staff Educational and Development Association
Henry Stewart Publications
Swets & Zeitlinger
Taylor and Francis
Triangle Journals
Trust for Wessex Archaeology
Turpin Distribution Services Ltd
University of Birmingham Press
Vathek Publishing
Vista Computer Services Ltd
Mary Waltham
John Wiley and Sons Ltd

Association of American Publishers (Professional & Scientific Publishers Division)

The AAP/PSP (Association of American Publishers Inc / Professional & Scholarly Publishers Division) is the US trade body representing the major scholarly and professional publishers in the USA.

Table A2.3 AAP/PSP members

Addison Wesley Longman
American Geophysical Union
Anointed Vision
Association of Research Libraries
Begell House, Inc.
Cambridge Scientific Abstracts
Congressional Quarterly Books
Walter De Gruyter, Inc.
Elsevier Science Inc.
Engineering Animation
The Faxon Company
Groves Dictionary
Harcourt Brace & Co. (Academic Press, W.B. Saunders)
Henry Holt & Co.
International Thomson (Chapman & Hall, Van Nostrand Reinhold, West Publishing Company)
The McGraw-Hill Companies, Inc.
Wil McKnight Associates, Inc.
Mosby-Year Book, Inc. (a Times Mirror Company)
National Computer Systems, Inc.
The National Underwriter Company
Reed Reference Publishing
Reuters Health Information Services
Lynne Rienner Publishers, Inc.
Scovill, Paterson Inc./ Primary Eyecare Communication
Sengstack Foundation for Early Childhood
Simon & Schuster (Appleton & Lange, Charles Scribner's Sons)
Springer Publishing Co.
Springer-Verlag New York, Inc.
Time Warner Trade Publishing
Times Mirror
Todd Publishing Inc.
University Press of America, Inc.
John Wiley & Sons, Inc.

Table A2.4 AAP/PSP Associate Members

American Association for the Advancement of Science
American Chemical Society
American Foundation for the Blind
American Institute of Physics
American Medical Association
American Psychiatric Press
Association for Computing Machinery
Association for Supervision and Curriculum Development
BOMI Institute
Cold Spring Harbor Laboratory Press
J. Paul Getty Trust Publications
Health Affairs/Project Hope
Institute for International Economics
The Institute of Electrical and Electronics Engineers, Inc.
International Reading Association
International Life Sciences Institute
Massachusetts Medical Society / New England Journal of Medicine
The Mathematical Association of America
Medical Group Management Association
National Association of Social Workers
National Center on Education & the Economy
New York Academy of Sciences
OCLC Online Computer Library Center, Inc.
Recording for the Blind and Dyslexic
Special Libraries Association
University Press Associates
The Brookings Institution
Cambridge University Press
Columbia University Press
Cornell University Press
Fordham University Press
Harvard Business School Press
Harvard University Press
Howard University Press
Iowa State University Press
The MIT Press
Northeastern University Press
New York University Press
Ohio State University Press
Oxford University Press
The Pennsylvania State University Press
Princeton University Press
Purdue University Press
Rockefeller University Press
Rutgers University Press
Teachers College Press
University of California Press
University of Chicago Press
The University of Hawaii Press
The University of North Carolina Press, Inc.
University of Oklahoma Press
University of Pittsburgh Press
University Press of Kentucky
University of South Carolina Press
University of Texas Press
Yale University Press

Appendix III Project Steering Committee

The steering committee for this project was chaired by Neil McLean, Macquarie University, and convened by Virginia Walsh. Members included:

- Dr Rory Ewins, Australian Vice-Chancellors' Committee;
- Helen Hayes, Melbourne University;
- Prof Ron Johnston, Australian Centre for Innovation and International Competitiveness;
- Philip Kent, CSIRO;
- Cliff Law and David Toll, National Library of Australia.

The Committee would like to thank John Cox for his invaluable input into the project and participation in steering committee meetings, and all those consulted during the course of research.

Notes

[1] The situation described below is known in the literature as 'the crisis in scholarly communication', but it might be characterised more accurately as a combination of fundamental technological change and system dysfunction.

[2] A 'public good' is one from which others cannot be excluded (eg. a public park) and is not destroyed in consumption.

[3] Kay, J. 1999, 'Business Strategy in the Knowledge Driven Economy,' in *The Economics of the Knowledge Driven Economy*, Conference Paper, November 1999, Department of Trade and Industry, London. http://www.dti.gov.uk/

[4] Odlyzko, A. (2000) 'The Rapid Evolution of Scholarly Communication,' Paper presented at PEAK 2000, March 2000. http://www.si.umich.edu/PEAK-2000/program.htm

[5] Reforms suggested in the 'West Review' in relation to the calculation of research quantum in Australian universities go a little way towards constructive reform, but not far enough to entirely overcome the dysfunctional impacts on scholarly publishing. See DEETYA (1997) *Learning for life: Review of higher education finacing and policy - a policy discussion paper*, AGPS, Canberra; and (1998) *Learning for life: Final Report*, AGPS, Canberra.

[6] See, for example, such projects as: LibEcon 2000 in Europe (http://www.libecon2000.org), JUSTEIS in the United Kingdom (http://www.dil.aber.ac.uk/dils/research/justeis), and a number of United States Association of Research Library initiatives (http://www.arl.org/stats).

[7] OECD 1997, *National Innovation Systems*, OECD, Paris.

[8] The situation described below is known in the literature as 'the crisis in scholarly communication', but it might be characterised more accurately as a combination of fundamental technological change and system dysfunction.

[9] McLean, N. 1999, 'Strategic Directions for Australia's research information infrastructure,' in DETYA 1999, *Australia's Information Future: Innovation and Knowledge Management for the 21st century*, p5.

[10] DTI 1998, *Building the Knowledge Driven Economy: Competitiveness White Paper*, Department of Trade and Industry, London. http://www.dti.gov.uk/comp/

[11] See, for example, DTI (1999) *The Economics of the Knowledge Driven Economy - Conference Papers*, Department of Trade and Industry, London. http://www.dti.gov.uk/

[12] See, for example, Arthur, W.B. (1996) 'Increasing returns and the new world of business,' *Harvard Business Review*, July-August 1996, pp100-109.

[13] See http://www.arl.org/stats/arlstats/

[14] Cummings, A.M., Witte, M.L, Bowen, W.G., Lazarus, L.O. and Ekman, R.H. (1992) *University Libraries & Scholarly Communication*: A Study Prepared for The Andrew W. Mellon Foundation, The Association of Research Libraries (ARL). See http://www.arl.org

[15] Bosch, S. (1999) *The Bowker Annual Library and Book Trade Almanac*, 44th Edition, 1999, R.R. Bowker, New Providence, New Jersey, pp508-509.

[16] Cummings, A.M., Witte, M.L, Bowen, W.G., Lazarus, L.O. and Ekman, R.H. (1992) *University Libraries & Scholarly Communication*: A Study Prepared for The Andrew W. Mellon Foundation, The Association of Research Libraries (ARL). See http://www.arl.org

[17] See, for example, Fishwick, F., Edwards, L. and Blagden, J. (1998) Economic Implications of Different Models of Publishing Electronic Journals for Professional Societies and other small Specialist Publishers, Report to the Joint Information Systems Committee, Electronic Libraries Program. www.ukoln.ac.uk/services/elib/papers/supporting; and McCabe, M.J.

(1999) 'Academic Journal Pricing and Market Power: A Portfolio Approach', Georgia Institute of Technology; and elsewhere.

[18] CISC 1999, *Innovation in Scholarly Communication*, Coalition for Innovation in Scholarly Communication (brochure), derived from a CAUL survey.

[19] See, for example, Wyly, B.J. (1998) 'Competition in Scholarly Publishing? What Publisher Profits Reveal,' *ARL Newsletter*, October 7-13, 1998 http://www.arl.org/newsltr/200/ See also Hunter, (1998) 'Electronic Journal Publishing: Observations from the inside,' *D-Lib*, http://www.dlib.org/dlib/July98/ and Odlyzko, A. (1998) 'The economics of electronic publishing,' *Journal of Electronic Publishing*, 4(1), http://www.press.umich.edu/jep/04-01/.

[20] See, for example, King, D.W. and Tenopir, C. (2000) 'Scholarly Journal and Digital Database Pricing: Threat or Opportunity?', Paper presented at PEAK 2000, 23-24 March 2000. Also Lieberman, Noll, R. and Steinmuller, W.E. (1992) 'The Sources of Scientific Journal Price Increases', Centre for Economic Policy Research Working Paper, Stanford University cited by McCabe, M.J. (1999) 'Academic Journal Pricing and Market Power: A Portfolio Approach', Georgia Institute of Technology.

[21] McCabe, M.J. (1999) 'Academic Journal Pricing and Market Power: A Portfolio Approach', Georgia Institute of Technology; and McCabe, M.J. (1998) 'The Impact of Publisher Mergers on Journal Prices: A Preliminary Report,' *ARL 200*. A finding that is supported by the original analysis of Lieberman et al.

[22] McCabe, M.J. (1998) 'The Impact of Publisher Mergers on Journal Prices: A Preliminary Report,' Georgia Institute of Technology; McCabe, M.J. (1998) 'The Impact of Publisher Mergers on Journal Prices: An Update,' *ARL 207*, p2.

[23] Yoon, C.K. (1998) 'Soaring Prices Spur a Revolt in Scientific Publishing,' *New York Times*, December 8th, 1998.

[24] Porter, M. 1990, *The Competitive Advantage of Nations*, Free Press, New York.; Porter, M. 1998, 'Clusters and the New Economics of Competition,' *Harvard Business Review*, November-December 1998, pp77-90; Roelandt, T. 1998, 'Cluster Analysis and the System of Innovation Approach: Research strategies and policy implications,' Paper presented to the *OECD Conference on Innovation Systems - Growth Engines for the 21st Century*, 19-20 November, 1998, Sydney; Roelandt, T. and den Hartog, P. (eds) 1999, *Cluster Analysis and Cluster-based Policy Making in OECD Countrie*s, OECD, Paris.

[25] Breschi, S. and Malerba, F. 1997, 'Sectoral Innovation Systems: Technology regimes, Schumpeterian dynamics and spatial boundaries', in Ed. Edquist, C. 1997, *Systems of Innovation: Technologies, Institutions and Organizations*, Pinter, London, pp130-152.

[26] Gann, D, 1996, 'Construction as a manufacturing process? Similarities and differences between industrialised housing and car production in japan', *Construction Management and Economics:* 14: 437-450; Gann, D. 1997, '*Technology and Industrial Performance in Construction*,' Paper prepared for the OECD Directorate for Science, Technology and Industry, OECD, Paris; Gann, D. and Slater, A. 1998, *Learning and Innovation Management in Project-based Firms*, Paper for the 2nd International Conference on Technology Policy and Innovation, Lisbon, August 3-5, 1998.

[27] Gann, D, 1996, 'Construction as a manufacturing process? Similarities and differences between industrialised housing and car production in japan', *Construction Management and Economics:* 14: 437-450; Gann, D. 1997, '*Technology and Industrial Performance in Construction*,' Paper prepared for the OECD Directorate for Science, Technology and Industry, OECD, Paris; Gann, D. and Slater, A. 1998, *Learning and Innovation Management in Project-based Firms*, Paper for the 2nd International Conference on Technology Policy and Innovation, Lisbon, August 3-5, 1998; Houghton, J.W., Tonar, P. and Marceau, J. 1998, *Mapping the Building and Construction Product System*, Department of Industry, Science and Resources, www.isr.gov.au; Houghton, J.W., Grieg, A.W. and Marceau, J. 1999, *Mapping the Textile, Clothing and Footwear Product System*, Department of Industry,

Science and Resources, www.isr.gov.au; Houghton, J.W., Pappas, N. and Sheehan, P. 1999, 'New Manufacturing: One Approach to the Knowledge Economy,' CSES Working Paper 12, Victoria University, Melbourne www.cfses.com.

[28] See King, D.W. et al (1976) Statistical Indicators of Scientific and Technical Communication, 1960-1980, Volume 1, A Summary Report. GPO 083-000-00295-3.; King, D.W. and Roderer, N.K. (1978) Systems Analysisof Scientific and Technical Communications in the US, NTIS: PB281-847.; and King, D.W. and Tenopir, C. (2000) 'Scholarly Journal and Digital Database Pricing: Threat or Opportunity?', Paper presented at PEAK 2000, 23-24 March 2000.

[29] Monograph is used here to mean a low volume work intended primarily for academics and researchers, while textbook is used to mean a work which may be high volume and is intended for use as a teaching resource and by students. However, the distinction is not always clear cut.

[30] A dataset being a collection of databases.

[31] See http:///www.auslig.gov.au

[32] ABS (2000) *2000 Yearbook: Australia*, Cat No 1301.0 – Higher Education. Despite significant increases in student numbers, the number of academic staff increased by just 6,100 over the decade to 1998, or by 23 per cent.

[33] DETYA (1999) *Staff 1999: Selected Higher Education Statistics*, Department of Education, Training and Youth Affairs, Canberra, p5.

[34] DETYA (1999) Finance Statistics*: Selected Higher Education Statistics*, Department of Education, Training and Youth Affairs, Canberra, p17.

[35] ABS (2000) *2000 Yearbook: Australia*, Cat No 1301.0 – Higher Education.

[36] ABS (1998) Research and Experimental Development: All Sector Summary, 1996-97, Cat No 8112.0

[37] It is worth noting that Australian census data report just 3,180 professional authors, although an ABS survey of 'The Arts' in 1997 showed that 120,500 people wrote on a paid-only basis, and a further 93,100 were paid for some, but not all, of their work. See Guldberg, H.H. (1999) *The Economics of Copyright and the Digital Agenda*, Copyright Agency Limited, p20.

[38] UNESCO (1998) *Statistical Yearbook, 1998*, cited by *The Bowker Annual Library and Book Trade Almanac*, 44th Edition, 1999, R.R. Bowker, New Providence, New Jersey, pp550-551.

[39] ISBN agency information. See http://www.thorpe.com.au Year-on-year variations may be due, in part, to block ISBN allocations to publishers.

[40] Ulrich's (2000) *Ulrich's International Periodicals Directory, 2000*, Bowker, pviii. And the Internet Edition at http://www.bowker.com/ulricks

[41] ISSN (2000) *Statistics of the ISSN Register*, April 2000, http://www.issn.org/stateng.html

[42] DIST (1996) *Australian Business Innovation: A Strategic Analysis*, Department of Industry, Science and Technology, Canberra.

[43] Bourke, P., Butler, L. and Biglia, B. (1996) *Monitoring Research in the Periphery: Australia and the ISI Indices*, Research School for Social Sciences, Australian National University, Canberra, p61.

[44] Because of the general nature of these latter they are given no further consideration in this report.

[45] ABS (1999) Manufacturing Industry, Australia 1997-98, Cat No 8221.0.

[46] ABS (1999) Manufacturing Industry, Australia 1997-98, Cat No 8221.0.

[47] Houghton, J.W. (1999) *Information Industries Update 1999*, CSES, Victoria University, Melbourne.

[48] Estimate suggested by John Cox, a leading industry analyst. John Cox and Associates, United Kingdom.

[49] See http://www.reed-elsevier.com

[50] See http://www.harcourtgeneral.com

[51] A merger between Reed-Elsevier and Wolters-Kluwer was blocked in 1998 due to European concerns over the potential control it would give them over legal publications.

[52] Some sense of the scale and scope of commercial publishing operations can be gleaned from the brief details on a few of the major scholarly publishers provided in Appendix I.

[53] A few of the major association publishers of scholarly journals and books are featured in brief review in Appendix I to give some sense of the nature and scale of their activities.

[54] This description is drawn from a number of published sources, consultation and personal experience.

[55] Estimate suggested by John Cox, a leading industry analyst. John Cox and Associates, United Kingdom.

[56] *The Bowker Annual Library and Book Trade Almanac*, 44th Edition, 1999, R.R. Bowker, New Providence, New Jersey, p538.

[57] ABS (1999) Manufacturing Industry, Australia 1997-98, Cat No 8221.0.

[58] ABS (1999) Manufacturing Industry, Australia 1997-98, Cat No 8221.0.

[59] ABS (1999) Book Publishers, Australia 1997-98, Cat No 1363.0.

[60] IC (1996) *Book Printing*, Industry Commission Draft Report, August 1996.

[61] Baker, J.F. (1999) 'Trade Book Sales up 6% In 1998: BISG Report,' *PublishersWeekly.com*, 08/23/1999. See http://www.publishersweekly.com

[62] *The Bowker Annual Library and Book Trade Almanac*, 44th Edition, 1999, R.R. Bowker, New Providence, New Jersey, p542.

[63] ABS (1999) Libraries and Museums, Australia 1996-97, Cat No 8649.0.

[64] There were 1,256 hospital facilities in Australia in 1997-98.

[65] CAUL (1999) *CAUL Statistics*, Council of Australian University Librarians, Canberra.

[66] CAUL (1999) *CAUL Statistics*, Council of Australian University Librarians, Canberra.

[67] NLA (1999) National Library of Australia, Annual Report 1998, NLA, Canberra.

[68] Additional purchases of books, technical reports, standards and patents are managed by individual CSIRO libraries, and approximately $400,000 worth of serials and memberships are ordered annually by CSIRO libraries outside the central agreements.

[69] DETYA (1999) *Students (Preliminary) 1999: Selected Higher Education Statistics*, Department of Education, Training and Youth Affairs, Canberra, p11.

[70] ABS (1998) Research and Experimental Development: All Sector Summary, 1996-97, Cat No 8112.0

[71] This $4 billion also includes expenditure on fuel, rent, hiring, repairs and maintenance and data processing. ABS (1998) *Research and Experimental Development: All Sector Summary, 1996-97*, Cat No 8112.0.

[72] ABS (1993) *Wholesale Industry, Australia*, Cat No 8638.0.

[73] IC (1996) *Book Printing*, Industry Commission Draft Report, August 1996, p6.

[74] ABS (1999) Book Publishers, Australia 1997-98, Cat No 1363.0.

[75] ABS (1993) *Retailing in Australia*, Cat No 8613.0.

[76] ABA (1999) *Economic Survey 1997-98*, Australian Booksellers Association, Sydney.

[77] See http://www.swets.nl

[78] See http://www.rowe.com

[79] See http://www.epnet.com

[80] *Ulrich's International Periodicals Directory, 2000,* R.R Bowker, New Jersey. Web Edition.

[81] *Ulrich's International Periodicals Directory, 2000,* R.R Bowker, New Jersey.

[82] Baker, J.F. (1999) 'Trade Book Sales up 6% In 1998: BISG Report,' *PublishersWeekly.com*, 08/23/1999. See http://www.publishersweekly.com

[83] Euromonitor International (2000) *Internet Retailing: A global overview*, 1999 Edition. See http://www.euromonitor.com/pdf/InternetRetailing.pdf

[84] ABS (1999) Expenditure on Education, Australia, 1997-98, Cat No 5510.0 and ABS (1998) Research and Experimental Development: All Sector Summary, 1996-97, Cat No 8112.0

[85] And, of course, the social significance of education and research could hardly be greater.

[86] ABS (2000) *2000 Yearbook: Australia*, Cat No 1301.0 – Education and Training, Introduction.

[87] ABS (2000) *2000 Yearbook: Australia*, Cat No 1301.0 – Tertiary Education.

[88] ABS (1998) Research and Experimental Development: All Sector Summary, 1996-97, Cat No 8112.0

[89] ABS (1998) Research and Experimental Development: All Sector Summary, 1996-97, Cat No 8112.0

[90] ABS (1999) Expenditure on Education: Australia, 1997-98, Cat No 5510.0.

[91] Houghton, J.W. (1999) *Information Industries Update 1999*, CSES, Victoria University, Melbourne.

[92] It is estimated that around 7 per cent of Australia's gross domestic product depends upon copyright, a figure that is expected to increase rapidly (cited by the Australian Performing Rights Association).

[93] See http://www.copyright.org.au

[94] See http://www.IPAustralia.gov.au

[95] See http://www.dcita.gov.au

[96] CAL http://copyright.com.au

[97] CAL (1999) Copyright Agency Limited Annual Report 1998-99, CAL, Sydney.

[98] CAL reports suggest that Australian universities have paid $10 million to $12 million per annum to them in recent years, and estimate that they will pay around $15 million in 2000. CAL, personal communication.

[99] See http://www.dcita.gov.au/

[100] See http://www.dcita.gov.au/

[101] King, D.W. and Tenopir, C. (2000) 'Scholarly Journal and Digital Database Pricing: Threat or Opportunity?', Paper presented at PEAK 2000, 23-24 March 2000.

[102] Bourke, P., Butler, L. and Biglia, B. (1996) *Monitoring Research in the Periphery: Australia and the ISI Indices*, Research School for Social Sciences, Australian National University, Canberra, p61.

[103] DTI (1999) *Economics of the Knowledge Driven Economy*, Conference Proceedings, Department of Trade and Industry, London, p6.

[104] Sigismund, C. (1995) 'The New Knowledge Organisation', *SRI International*, p11.

[105] Industry Canada (1997) '*Towards a Society Built on Knowledge,'* Industry Canada. See http://strategis.ic.gc.ca/SSG/ih01644e.html

[106] See Swan, A. and Brown, S. (1999) *What Authors Want: the Motivations and Concerns of contributors to Learned Journals*, ALPSP, London cited in Halliday, L. and Oppenheim, C. (1999) *Economic Models of the Digital Library*, E-Lib, p24 and elsewhere, for the importance of professional motivations in the overall picture.

[107] Swan, A. (1999) *What Authors Really Want*, ALPSP Author Survey, 1999. See http://www.alpsp.org.uk/pubs.htm

[108] Halliday, L. and Oppenheim, C. (1999) *Economic Models of the Digital Library*, eLib, United Kingdom Office of Library and Information Networking, p12 citing Lesk, M. (1997) *Practical Digital Libraries: Books, Bytes and Bucks*, Morgan Kauffman, and Fishwick, F., Edwards, L. and Blagden, J. (1998) *Economic Implications of Different Models of Publishing Electronic Journals for Professional Societies and other small Specialist Publishers*, Report to the Joint Information Systems Committee, Electronic Libraries Program. www.ukoln.ac.uk/services/elib/papers/supporting

[109] Harnad, S. (1996) 'Implementing peer review on the net: scientific quality control in scholarly electronic journals,' in Peek, R. and Newby, G. (1996) *Scholarly Publishing: The Electronic Frontier*, MIT Press, Cambridge MA, and Harnad, S. and Hemus, M. (1997) 'All or None: No stable hybrid or half-way solutions for launching the learned periodical literature into the post-Gutenburg galaxy,' in Butterworth, I. (1996) *The Impact of Electronic Publishing on the Academic Community*, Portland Press, London, cited by Halliday, L. and Oppenheim, C. (1999) *Economic Models of the Digital Library*, eLib, United Kingdom Office of Library and Information Networking, United Kingdom Office of Library and Information Networking .

[110] See Halliday, L. and Oppenheim, C. (1999) *Economic Models of the Digital Library*, eLib, United Kingdom Office of Library and Information Networking, p11.

[111] See, for example, McCabe, M.J. (1999) 'Academic Journal Pricing and Market Power: A Portfolio Approach', Georgia Institute of Technology.

[112] Halliday, L. and Oppenheim, C. (1999) *Economic Models of the Digital Library*, eLib, United Kingdom Office of Library and Information Networking, p82.

[113] Halliday, L. and Oppenheim, C. (1999) *Economic Models of the Digital Library*, eLib, United Kingdom Office of Library and Information Networking, p94.

[114] Halliday, L. and Oppenheim, C. (1999) *Economic Models of the Digital Library*, eLib, United Kingdom Office of Library and Information Networking, p71.

[115] It should be noted that this is a rather extreme minority view. It is mentioned here for the sake of completeness.

[116] See Kostelnick cited in Halliday, L. and Oppenheim, C. (1999) *Economic Models of the Digital Library*, eLib, United Kingdom Office of Library and Information Networking, p25.

[117] See, for example, Harnad, S. 1995, 'The post-Gutenberg Galaxy: how to get there from here', Information Society 11(4), pp285-91 and elsewhere. See http://www.cogsci.soton.ac.uk/~harnad See also Duranceau, E.F. (ed.) (1995) The Economics of Electronic Publishing, *Serials Review*, 21(1) and Varian, H. (1998) The Future of Electronic Publishing, *Journal of Electronic Publishing* 4(1), http://www.press/umich/edu/jep/04-01/ cited by Halliday, L. and Oppenheim, C. (1999) *Economic Models of the Digital Library*, eLib, United Kingdom Office of Library and Information Networking, United Kingdom Office of Library and Information Networking .

[118] Halliday, L. and Oppenheim, C. (1999) *Economic Models of the Digital Library*, eLib, United Kingdom Office of Library and Information Networking, United Kingdom Office of Library and Information Networking .

[119] Based on the work of Oliver Williamson and Edith Penrose, respectively.

[120] See, for example, Day, C. (1998) 'Digital Alternatives: solving the problem or shifting the costs?' *Journal of Electronic Publishing*, 4(1), http://www.press.umich.edu/jep/04-01/; and others cited in Halliday, L. and Oppenheim, C. (1999) *Economic Models of the Digital Library*, eLib, United Kingdom Office of Library and Information Networking, p26.

[121] See, for example, Bot, M., Burgmeester, J. and Roes, H. (1998) 'The cost of publishing and electronic journal: a general model and a case study,' *D-Lib Magazine*,

http://mirrored.ukoln/ac/uk/lis-journals/dlib/november98/; Harnad, S. (1996) 'Implementing peer review on the net: scientific quality control in scholarly electronic journals,' in Peek, R. and Newby, G. (1996) *Scholarly Publishing: The Electronic Frontier*, MIT Press, Cambridge MA; Harnad, S. and Hemus, M. (1997) 'All or None: No stable hybrid or half-way solutions for launching the learned periodical literature into the post-Gutenburg galaxy,' in Butterworth, I. (1996) *The Impact of Electronic Publishing on the Academic Community*, Portland Press, London; and Fishwick, F., Edwards, L. and Blagden, J. (1998) *Economic Implications of Different Models of Publishing Electronic Journals for Professional Societies and other small Specialist Publishers*, Report to the Joint Information Systems Committee, Electronic Libraries Program. www.ukoln.ac.uk/services/elib/papers/supporting cited by Halliday, L. and Oppenheim, C. (1999) *Economic Models of the Digital Library*, eLib, United Kingdom Office of Library and Information Networking, United Kingdom Office of Library and Information Networking

[122] See also Day, C. (1998) 'Digital Alternatives: solving the problem or shifting the costs?' *Journal of Electronic Publishing*, 4(1), http://www.press.umich.edu/jep/04-01/; Hunter, K. (1998) 'Electronic Journal Publishing: observations from the inside,' D-Lib Magazine http://www.dlib.org/dlib/July98/ and others cited in Halliday, L. and Oppenheim, C. (1999) *Economic Models of the Digital Library*, eLib, United Kingdom Office of Library and Information Networking, p8.

[123] Lesk, M. (1997) Practical Digital Libraries: Books, Bytes and Bucks, Morgan Kauffman cited in Halliday, L. and Oppenheim, C. (1999) *Economic Models of the Digital Library*, eLib, United Kingdom Office of Library and Information Networking, p47.

[124] Some pre-print proposals involve launching papers onto the pre-print server once it is submitted, and then updating its status as it passes through the review process, others are a simple 'free-for-all'.

[125] Cox, J. (2000) 'Scholarly Communication in the Third Milleneum: Making sense of economic, technical and management challenges,' presented at Sustainability in the Scholarly Communication Marketplace, Macquarrie University Seminar, Sydney, May 2nd 2000. See http://www.lib.mq.edu.au/conference/sustainability/index.html

[126] Odlyzko, A. (2000) 'The Rapid Evolution of Scholarly Communication,' Paper presented at PEAK 2000, March 2000. http://www.si.umich.edu/PEAK-2000/program.htm

[127] OECD (1997) *National Innovation Systems*, OECD, Paris.

[128] Arthur, W.B. 1996, 'Increasing returns and the new world of business,' *Harvard Business Review*, July-August 1996, pp100-109.

[129] Kay, J. 1999, 'Business Strategy in the Knowledge Driven Economy,' in *The Economics of the Knowledge Driven Economy*, Conference Paper, November 1999, Department of Trade and Industry, London. http://www.dti.gov.uk/

[130] Kay, J. 1999, 'Business Strategy in the Knowledge Driven Economy,' in *The Economics of the Knowledge Driven Economy*, Conference Paper, November 1999, Department of Trade and Industry, London, p33. http://www.dti.gov.uk/

[131] Wyly, B.J. (1998) 'Competition in Scholarly Publishing? What Publisher Profits Reveal,' *ARL 200*; and subsequent updates. See http://www.arl.org/newsltr/200/wyly.html

[132] There is no ideal indicator, but gross operating margin (return from sales after expenses), net operating margin (the same after tax) and return on equity (net shareholder reward to investment) are the most commonly used indicators.

[133] Reed Elsevier (1999) *Reed Elsevier Annual Report 1998*, pp23-24.

[134] Wyly, B.J. (1998) 'Competition in Scholarly Publishing? What Publisher Profits Reveal,' *ARL*, 200.

[135] *BRW Top 1000*, Reed Elsevier (1999) *Annual Report 1998*, and Wyly, B.J. (1998) 'Competition in Scholarly Publishing? What Publisher Profits Reveal,' *ARL*, 200.

[136] Neal, J.G. (1997) 'The Use of Scholarly Journals,' http://www.arl.org/scomm/scat/neal.htm cited by Halliday, L. and Oppenheim, C. (1999) *Economic Models of the Digital Library*, eLib, United Kingdom Office of Library and Information Networking, p28.

[137] Notwithstanding its present difficulties Microsoft represents one of the more successful business models of recent years – bundling software with every PC sold. Given the experience of Microsoft, and subsequently Encarta, major commercial publishers might consider putting their entire lists 'free-to-air' on internet and bundling access software with every PC sold. What parent would deny access to an entire list of scholarly journals to their child for the sake of saving $20 off the price of a PC?

[138] King, D.W. and Tenopir, C. 1998, 'Economic Cost Models of Scientific Scholarly Journals,' *Proceedings of ICSU Workshop*, University of Oxford, 31 March to 2 April, 1998. See also King, D.W. and Tenopir, C. (2000) 'Scholarly Journal and Digital Database Pricing: Threat or Opportunity?', Paper presented at PEAK 2000, 23-24 March 2000.

[139] Varian, H. 1997, *The Future of Electronic Journals*, University of California, Berkeley.

[140] See papers by Shirrell, R., Getz, M. and Fisher, J.H. in 'Economics of Electronic Publishing: Costs Issues,' Scholarly Communication and Technology Conference, The Andrew W. Mellon Foundation, Emory University, April 24-25, 1997.

[141] King, D.W. and Tenopir, C. (2000) 'Scholarly Journal and Digital Database Pricing: Threat or Opportunity?', Paper presented at PEAK 2000, 23-24 March 2000.

[142] King, D.W. and Tenopir, C. (2000) 'Scholarly Journal and Digital Database Pricing: Threat or Opportunity?', Paper presented at PEAK 2000, 23-24 March 2000.

[143] See, for example, Bot, M., Burgmeester, J. and Roes, H. (1998) 'The cost of publishing and electronic journal: a general model and a case study,' *D-Lib Magazine*, http://mirrored.ukoln/ac/uk/lis-journals/dlib/november98/; Harnad, S. (1996) 'Implementing peer review on the net: scientific quality control in scholarly electronic journals,' in Peek, R. and Newby, G. (1996) *Scholarly Publishing: The Electronic Frontier*, MIT Press, Cambridge MA; Harnad, S. and Hemus, M. (1997) 'All or None: No stable hybrid or half-way solutions for launching the learned periodical literature into the post-Gutenburg galaxy,' in Butterworth, I. (1996) *The Impact of Electronic Publishing on the Academic Community*, Portland Press, London; and Fishwick, F., Edwards, L. and Blagden, J. (1998) *Economic Implications of Different Models of Publishing Electronic Journals for Professional Societies and other small Specialist Publishers*, Report to the Joint Information Systems Committee, Electronic Libraries Program. www.ukoln.ac.uk/services/elib/papers/supporting cited by Halliday, L. and Oppenheim, C. (1999) *Economic Models of the Digital Library*, eLib, United Kingdom Office of Library and Information Networking .

[144] See Day, C. (1998) 'Digital Alternatives: solving the problem or shifting the costs?' *Journal of Electronic Publishing*, 4(1), http://www.press.umich.edu/jep/04-01/; Hunter, K. (1998) 'Electronic Journal Publishing: observations from the inside,' D-Lib Magazine http://www.dlib.org/dlib/July98/ and others cited in Halliday, L. and Oppenheim, C. (1999) *Economic Models of the Digital Library*, eLib, United Kingdom Office of Library and Information Networking, p8.

[145] King, D.W. and Tenopir, C. 1998, 'Economic Cost Models of Scientific Scholarly Journals,' *Proceedings of ICSU Workshop*, University of Oxford, 31 March to 2 April, 1998.

[146] Regier, W.G. (1997) 'Epic: Electronic Publishing is Cheaper,' Scholarly Communication and Technology Conference, The Andrew W. Mellon Foundation, Emory University, April 24-25, 1997.

[147] King, D.W. and Tenopir, C. 1998, 'Economic Cost Models of Scientific Scholarly Journals,' *Proceedings of ICSU Workshop*, University of Oxford, 31 March to 2 April, 1998.

[148] Shirrell, R. (1997) 'Comments: Economics of Electronic Publishing: Costs Issues,' Scholarly Communication and Technology Conference, The Andrew W. Mellon Foundation, Emory University, April 24-25, 1997.

[149] Fisher, J.H. (1997) 'Comparing Electronic Journals to Print Journals: Are There Savings?' Scholarly Communication and Technology Conference, The Andrew W. Mellon Foundation, Emory University, April 24-25, 1997.

[150] Halliday, L. and Oppenheim, C. (1999) *Economic Models of the Digital Library*, eLib, United Kingdom Office of Library and Information Networking .

[151] Halliday, L. and Oppenheim, C. (1999) *Economic Models of the Digital Library*, eLib, United Kingdom Office of Library and Information Networking, pp29-30.

[152] Reported in Halliday, L. and Oppenheim, C. (1999) *Economic Models of the Digital Library*, eLib, United Kingdom Office of Library and Information Networking, p30.

[153] Example cited in Halliday, L. and Oppenheim, C. (1999) *Economic Models of the Digital Library*, eLib, United Kingdom Office of Library and Information Networking, p31.

[154] Varian, H. 1997, *The Future of Electronic Journals*, University of California, Berkeley.

[155] King, D.W. and Tenopir, C. 1998, 'Economic Cost Models of Scientific Scholarly Journals,' *Proceedings of ICSU Workshop*, University of Oxford, 31 March to 2 April, 1998.

[156] Evidence in papers, such as, Sanville, T. (1999) 'Use levels and new models for consortial purchasing of electronic journals,' *Library Consortium Management*, 1(3/4), pp47-58, is supported by early evidence in Australia (eg. CSIRO).

[157] Sanville, T. (1999) 'Use levels and new models for consortial purchasing of electronic journals,' *Library Consortium Management*, 1(3/4), p51 and p53.

[158] Varian, H. 1995, *Pricing Information Goods*, University of Michigan.

[159] Halliday, L. and Oppenheim, C. (1999) *Economic Models of the Digital Library*, eLib, United Kingdom Office of Library and Information Networking, p15.

[160] McCabe, M. 1998, *The Impact of Publisher Mergers on Journal Prices*, Georgia Institute of Technology.

[161] Halliday, L. and Oppenheim, C. (1999) *Economic Models of the Digital Library*, eLib, United Kingdom Office of Library and Information Networking, p15.

[162] Indeed, McCabe found that in the field of medical journals over the decade 1988 to 1998 prices were positively related to firm portfolio size. See McCabe, M. 1998, *The Impact of Publisher Mergers on Journal Prices*, Georgia Instate of Technology.

[163] Varian, H. 1995, *Pricing Information Goods*, University of Michigan.

[164] Odlyzko, A. (1998) 'The economics of electronic publishing,' *Journal of Electronic Publishing*, 4(1), http://www.press.umich.edu/jep/04-01/ cited by Halliday, L. and Oppenheim, C. (1999) *Economic Models of the Digital Library*, eLib, United Kingdom Office of Library and Information Networking .

[165] Varian, H. 1995, *Pricing Information Goods*, University of Michigan.

[166] See Halliday, L. and Oppenheim, C. (1999) *Economic Models of the Digital Library*, eLib, United Kingdom Office of Library and Information Networking, p20.

[167] Kingston, P, Gadd, E. and Poulter, A. (1997) 'Project ACORN: User reactions,' *Learned Publishing* 10(4) cited in Halliday, L. and Oppenheim, C. (1999) *Economic Models of the Digital Library*, eLib, United Kingdom Office of Library and Information Networking .

[168] Deneckere, R.J. and McAfee, R.P. 1994, *Damaged Goods*, University of Texas, Austin.

[169] Cooper, M. (1989) 'A cost comparison of alternative book storage strategies,' *Library Quarterly*, 59(3), cited by Varian, H. *The Future of Electronic Journals*, UC Berkeley.

[170] Bowan, W.G. (1996) 'JSTOR and the economics of scholarly communication,' Cited in Halliday, L. and Oppenheim, C. (1999) *Economic Models of the Digital Library*, eLib, United Kingdom Office of Library and Information Networking, p77.

[171] Odlyzko, A. (1998) 'The economics of electronic publishing,' *Journal of Electronic Publishing*, 4(1), http://www.press.umich.edu/jep/04-01

[172] See AARL statistics at http://caul.anu.edu.au

[173] Odlyzko, A. (1998) 'The economics of electronic publishing,' *Journal of Electronic Publishing*, 4(1), http://www.press.umich.edu/jep/04-01 and Varian, H. (1997) *The Future of Electronic Journals*, University of California, Berkeley.

[174] Comment by Helen Hayes, University of Melbourne and CAUL.

[175] Halliday, L. and Oppenheim, C. (1999) *Economic Models of the Digital Library*, eLib, United Kingdom Office of Library and Information Networking, p76.

[176] This characterisation is taken from McCabe, M. (1998) *The Impact of Publisher Mergers on Journal Prices*, Georgia Institute of Technology.

[177] McCabe, M. 1998, *The Impact of Publisher Mergers on Journal Prices*, Georgia Institute of Technology.

[178] McCabe, M. 1998, *The Impact of Publisher Mergers on Journal Prices: An update*, ARL. See http://www.arl.org/newsltr/207/jmlprices.html

[179] McCabe's example of biomedical journals in the United States showed that a 1 per cent increase in price resulted in a 0.3 per cent decrease in subscriptions. See McCabe, M. 1998, *The Impact of Publisher Mergers on Journal Prices: An update*, ARL. See http://www.arl.org/newsltr/207/jmlprices.html

[180] Cummings, A.M., Witte, M.L, Bowen, W.G., Lazarus, L.O. and Ekman, R.H. (1992) *University Libraries and Scholarly Communication*: A Study Prepared for The Andrew W. Mellon Foundation, The Association of Research Libraries (ARL).

[181] Noll, R. and Steinmeuller, W.E. (1992) 'An Economic Analysis of Scientific Journal Prices: Preliminary results,' *Serials Review*, 18, pp32-37 cited by Cummings, A.M., Witte, M.L, Bowen, W.G., Lazarus, L.O. and Ekman, R.H. (1992) *University Libraries & Scholarly Communication*: A Study Prepared for The Andrew W. Mellon Foundation, The Association of Research Libraries (ARL), Chapter 6.

[182] Cummings, A.M., Witte, M.L, Bowen, W.G., Lazarus, L.O. and Ekman, R.H. (1992) *University Libraries & Scholarly Communication*: A Study Prepared for The Andrew W. Mellon Foundation, The Association of Research Libraries (ARL).

[183] Cummings, A.M., Witte, M.L, Bowen, W.G., Lazarus, L.O. and Ekman, R.H. (1992) *University Libraries & Scholarly Communication*: A Study Prepared for The Andrew W. Mellon Foundation, The Association of Research Libraries (ARL).

[184] In reality, the way forward is likely to involve all of the suggestions outlined below, and more.

[185] Odlyzko, A. (2000) 'The Rapid Evolution of Scholarly Communication,' Paper presented at PEAK 2000, March 2000. http://www.si.umich.edu/PEAK-2000/program.htm

[186] Such as OhioLink and PEAK.

[187] There will, of course, be a degree of experimentation with the new medium, which would also result in both more and different use.

[188] Whinston, A.B., Stahl, D.O. and Choi, S-Y. (1997) *The Economics of Electronic Commerce*, Macmillan.

[189] Arthur, W.B. (1990) 'Positive Feedbacks in the Economy', *Scientific American*, Feb 1990; and Arthur, W.B. (1996) 'Increasing Returns and the New World of Business', *Harvard Business Review*, July-Aug 1996.

[190] Quah, D.T. (1996) 'The Invisible Hand and the Weightless Economy', Occasional Paper No 12, London School of Economics; and Coyle, D. (1998) *The Weightless World: Strategies for Managing the Digital Economy*, MIT Press .

[191] Yoffie, D.B. (ed) (1997) *Competing in the Age of Digital Convergence*, Harvard Business School Press.

[192] Shapiro, C. and Varian, H. (1999) *Information Rules: A Strategic Guide to the Information Economy*, Harvard Business School Press.

[193] Tapscott, D. (ed) (1999) *Creating Value in the Network Economy*, Harvard Business School Press.

[194] Leebaert, D. (ed) (1998) *The Future of the Electronic Marketplace*, MIT Press.

[195] Tapscott, D., Lowy, A. and Ticoll, D. (eds) (1998) *Blueprint to the Digital Economy: Wealth Creation in the Era of E-Business*, McGraw-Hill.

[196] Negroponte, N. (1996) *Being Digital*, Vintage Books.

[197] Tapscott, D. (1997) *The Digital Economy: Promise and Peril in the Age of Networked Intelligence*, McGraw-Hill.

[198] Glazer, R. (1993) 'Measuring the Value of Information: The Information Intensive Organisation', *IBM Systems Journal*, 32(1); and Moody, D. and Walsh, P. (1999) 'Measuring the Value of Information: An Asset Valuation Approach', *European Conference on Information Systems*, ECIS '99.

[199] Reforms suggested in the 'West Review' in relation to the calculation of research quantum in Australian universities go a little way towards constructive reform, but not far enough to entirely overcome the dysfunctional impacts on scholarly publishing. See DEETYA (1997) *Learning for life: Review of higher education finacing and policy - a policy discussion paper*, AGPS, Canberra; and (1998) *Learning for life: Final Report*, AGPS, Canberra.

[200] See, for example, such projects as: LibEcon 2000 in Europe (http://www.libecon2000.org), JUSTEIS in the United Kingdom (http://www.dil.aber.ac.uk/dils/research/justeis), and a number of United States Association of Research Library initiatives (http://www.arl.org/stats).

[201] Perhaps building on the approaches being explored in the USA. See, for example, Montgomery, C.H. and Sparks, J.A. (2000) 'Framework for Assessing the Impact of an Electronic Journal Collection on Library Costs and Staffing Patterns,' Drexel University, Paper presented at PEAK 2000, March 2000 (http://www.si.umich.edu/PEAK-2000/program.htm) and Sanville, T. (1999) 'Use levels and new models for consortial purchasing of electronic journals,' *Library Consortium Management*, 1(3/4).

[202] See http://www.harcourtgeneral.com

[203] See http://www.blackwellpublishers.co.uk

[204] See http://www.reed-elsevier.com

[205] Cahners (1999) *Cahners Fatcs: Connect the Numbers*. See http://www.cahners.com

[206] See http://www.cup.cam.ac.uk

[207] See http://www.hbsp.edu

[208] Project MUSE at http://muse.jhu.edu and the Project MUSE Newsletter, *MUSE News*.

[209] See http://www.mitpress.mit.edu

[210] See http://www.oup.com

[211] See http://www.mup.unimelb.edu.au

[212] See http://www.acm.org

[213] See http://www.acs.org

[214] Getz, M. (1997) 'Electronic Publishing in Academia: An Economic Perspective', Scholarly Communication and Technology Conference, The Andrew W. Mellon Foundation, Emory University, April 24-25, 1997.

[215] See http://www.aip.org

[216] See http://www.ieee.org