THE IMPACT OF DISINTERMEDIATION AND THE NEW ECONOMY ON STM ELECTRONIC INFORMATION SYSTEMS

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The process of change, as a result of the impact of the Internet and the new economy, is having profound effects on the current stakeholders in scholarly information, notably among intermediaries. This report challenges the efficacy of the traditional model of journal publishing in its relevance to the new electronic information order. In particular it highlights disillusionment among the end users and suggests that there is a new role for intermediaries – that of providing effective navigation to bring those who are not part of the subscription and consortia arrangements into the information system.

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Introduction

Those who forecast the demise of the printed journal many years ago – and I freely admit to being one of them – have been proven wrong. The 'valley of death' scenario has not happened. Some of the larger publishers are effectively making the transition from being print-based journal publishers to being largely dependent on revenues from the electronic information system – Elsevier and Academic Press spring to mind.

But there are tensions within the existing system. One such area is the role of information intermediaries. For over half a century this was the preserve of the subscription agent for journals, who offered services to both publishers and librarians, receiving income from both accordingly. The value proposition they offered was such that the subscription agents grew in size and significance as the print journal business grew. Library budgets have not, however, been growing to cope with the growth in information and tales of declining subscription sales have been legion. There are no signs that library budgets will ever return to the halcyon days of the 1970s.

Now the rules are changing. Driven by technology and business principles which bear little relationship to the old rules, a new sector is emerging which focuses on meeting the new electronic needs of the scholars and researchers. It is these new business principles, these new needs and the new functions that the new players are addressing, which form the focus of this report.

Background

During the past ten years there has been a dramatic change in the formats acceptable within the scholarly communication process. Whereas we had books, journals and microforms in the 1970s, as well as access to bibliographic database vendors, such as Dialog,

SDC and BRS, business carried on relatively unchanged until the early 1990s.

Now we have increasing computerisation. Forecasts that the industry would be served by a few large computers were proven wrong by the dramatic upsurge in personal computers. Some 40% of new students entering higher education in the United Kingdom come with their own laptops.

This set the stage for a significant change in the way information could be delivered. Online journals emerged, electronic pre-print servers were developed in specialist areas, remote access to the raw material (rather than the published findings in journal articles) was demanded. Supplementary material to the journal article in the form of still and moving images or specialised software to manipulate the raw data is required in some subject areas. E-mail supplanted paper-based communication. Portals, gateways and hubs became the new communities for specialist information exchange. Nicholas Negroponte, in his book, Being Digital[1], emphasised that we had entered a world where we were no longer trading in atoms, but in bits – no longer in printed text but in online data. The STM process was at the forefront of this.

These changes also heralded a change in the service support infrastructure for journals. The age of cybermediation had dawned.

Why? What is it that this new breed of intermediaries – partly culled from subscription agents, partly from new agencies – could offer, which made them relevant to the new bit-based information process? What led to their creation?

(a) There is huge fragmentation in the supply and demand chain. Thousands of libraries world-wide (OCLC alone has relationships with over 30,000 libraries) are buying materials from over 50,000 serial publishers. This is as true of the old economy as it is for the new – it applies to a print as well as an electronic environment. Where there are such a dramatic number of suppliers and buyers attempting to interact over a large number of journal titles (approximately 20,000 in the scholarly and professional areas) there is the need for a middleman to make sense out of all this noise.

(b) The electronic process enables easier searching across a wide range of tagged material, something a computer can do faster than the human brain. This has led to vast amounts of digital material being brought together in an aggregation process. Offering a comprehensive collection that can be searched using current keyword and contextual search processes gives the additional value so much sought after in the electronic age.

In effect, a true consistent marketplace for online scholarly information has been created – a marketplace unconstrained by time, imprint, geography or subject matter. It allows users to achieve a greater comprehensiveness than hitherto in their search process across a broader critical mass. It is a new scale. But it requires aggregation of published information from a variety of sources.

Publishers are able to distribute their own electronic journals online. Elsevier Science, Springer, Wiley, Academic Press and Blackwell all have their electronic material aggregated on their own sites, and many smaller and medium sized publishers use agents to do this for them. But the point is that these are purely aggregations of their own material – boutiques of STM publications, and not an open marketplace. The marketplace – where readers are not aware of publisher imprints and brands – requires more than just a few publishers. It requires participation by the small, specialised society publishers just as much as by the large commercial publishers. ingenta, OCLC and the main subscription agents all have aggregations of electronic journals many times greater than even the largest of commercial journal publishers.

So the introduction of PCs into the hands of end users has created a new demand for a one-stop source for their online information requirements, a function which the disaggregated publishing and library communities are ill equipped to do themselves.

Current position of intermediaries

1. Who are these new aggregators who trade in critical mass? They come from:

   Subscription agencies:

- EBSCO
- Swets and Blackwells
- RoweCom including Faxon and IQ

   Publisher services agencies:

- HighWire

- ingenta including CatchWord and Dynamic Diagrams

  Repackagers:
- Ovid
- BioMedNet, Chemweb

  Fulltext linking agencies
- ISI Web of Science
- CSA,
- Silver-Platter

  Abstracting and indexing services:
- Chemical Abstracts Services (CAS)
- National Library of Medicine (Medline, PubMed, PubMed Central)

  Library services
- OCLC including Pica
- BLCMP

The key sector is the subscription agency. For a long time they have struggled against the label of 'disintermediation', a process of linking the supplier (the publisher) to the purchaser (the library), with the result that intermediaries have become redundant. This, however, has not happened, even though there has been a major restructuring of the industry into fewer, larger subscription agencies over the past few decades.

Intermediaries now face some additional new challenges caused by:

- self-publishing direct to web, by-passing both publisher and intermediary. The decentralised distribution of documents held on authors' own PCs, being accessed by the global community in the same way as holdings of music have been distributed freely by Napster, is being heralded as the stimulus for a new peer-to-peer information system, by-passing all intermediaries, publishers and librarians alike.
- the rise of powerful library consortia globally, which have the potential to by-pass the intermediary and concentrate the market into large regional and national purchasing blocks within the US, Asia, and increasingly in Europe and Australia.
- the rise of the publisher (boutique), which actually does have critical mass, and through acquisition could take an increasing share of the market, whilst retaining a kind of editorial monopoly (Elsevier's acquisition of Harcourt,

which brings nearly 20% of formal journal publications within the scope of one entity)
- the increasing influence of the publicly funded discovery network/research aggregation, which may pose longer-term threats.

These are all concentrating the market, to the detriment of the traditional intermediary, but none of these players is doing so universally and uniformly; few of them are providing comprehensive collections of content or metadata; and few of them are able to take the end user fully into account. Therein lies the opportunity for the forward thinking intermediary.

The needs of the end user

Research information is not solely the preserve of the academic institution. Greater diversity of interest in the results of research is being witnessed as society becomes ever more complex. Research data have become of interest to industry and financial consultants whose businesses depend on their evaluating the effects of the research on the community. Individuals, educated in a particular subject but practising in a different professional sector, will still want to keep track of what is happening in their old discipline. People with a medical ailment will want to know more about the latest cures before hospitalisation. Some research spans a variety of disciplines. In all these cases the end users will not be subscribers to the journals – their occasional needs are not met by their institution. They have no access to the academic library. They are in effect disenfranchised.

It is difficult to quantify the extent of this market-on-the-periphery. Forrester research claims there are 180 million knowledge workers worldwide. The numbers in the academic system may at best be 30 million. The gap represents this area of end users who are currently not being served effectively by an institutionalised system of journal subscriptions.

Nor is it the case that those who are franchised – who have access to the library and journals – are happy. Studies undertaken in the early 1990s show that disillusionment had set in even then with the existing academic institutions. Mercury Enterprises and the British Library commissioned

a market study in 1991 which demonstrated that 50% of the UK user base were disillusioned with the then prevailing (mainly print-based) means of communication. Users resorted to other, often informal, means of keeping in touch. Information overload was only part of the problem.

At the same time, the Faxon Institute was employing psychologists to investigate user behaviour patterns in several disciplines. One of the results of this research was that a typology of end users was reached, ranging from the information zealot to the information anxious. There were as many in the latter category as the former; in fact 20% of the users felt that they read less than 20% of what they needed to do their work properly, and only 20% felt that they read more than half of what they needed.

The point is that no-one talks to end users such as these, so the interests of the disillusioned are not being built into the existing or future information systems. How many publishers spend funds on drilling down into the motivational needs of all their patrons to provide an information service which truly reflects their needs rather than the shareholders' interests?

It is clear that the new intermediaries should provide systems which better reflect users' working needs and which also result in greater democratisation of information dissemination.

The scale of the problem

How large is the industry for scholarly communication? Is it large enough to warrant attention?

One of the largest consultancy organisations dealing in market research for the scholarly communication industry (Outsell) puts the size of the STM information content at $9,500 million. This is out of a total global information sector of $146 billion. So whilst STM is small in relation to all information sectors, it is nonetheless in its own right a sizeable industrial sector worldwide.

Of the STM total, Outsell has further estimated that the intermediary market for scholarly information is $1,600 million. Nearly 20% of the industry sector is involved in intermediary functions. Again, this is not a small sector by any means and one which, faced with challenges from new technology and new business practices, has to be effective and efficient if it is to survive. It

needs to serve the end users in a better way than has been the case in the print environment. How can it do this – by reaching out and offering more end users easy access to the sort of information which traditional systems had prevented them from doing?

ingenta is just one of the intermediaries which is becoming very active in promoting its aggregated services (of publisher material) to a broader market sector, reaching them through promotional campaigns in a range of industry organs. The aim is to make ingenta appear synonymous with scholarly information from sources of all kinds. Other intermediaries, in different ways, are either focusing on the library or end users to build up their brands as aggregators.

Basis for intermediary existence

'Melting the Glue'

The key driver toward the new set of functions which are operated by intermediaries in the electronic world is – 'Melting the glue'

This is a term coined by Evans and Wurster in their book, *Blown to Bits*[2], which essentially describes the growth of information about a product in a manufacturing process as an essential adjunct to controlling this process. In the electronic world this information – whether it is about the production process, quality controls, marketing and sales data, stock control, data on inventory, market research, logistics, fault identification and rectification – becomes an entity in its own right. It is metadata. One form that it takes is the catalogue of product information – in effect, the headers of journal articles are such information.

In the electronic world these data become a business in their own right – a business which has a growth rate substantially greater than the product itself. In traditional manufacturing processes – and this includes books and journals – growth increments are in arithmetic rates. However, because of the nature of the network within which electronic information operates, the more people that have access to the network, the more geometrically the growth in usage rates of the metadata.

An example of where this happened is with Amazon.com. Taking the information about books (cataloguing and stock control data from

book warehouses) and putting it together in a large single database (aggregated), Amazon was able to achieve growth rates (and at one time market valuations) far in excess of the book publishing industry giants on which it was based.

This process of separating the descriptive information (the 'metadata') from the raw product (the 'stuff) is what Evans and Wurster claim is the process of 'melting the glue'. The network not only allows this to happen, it promotes it.

Requirements – connectivity and open standards

Two essential ingredients are necessary for this melting to take place:

(a) connectivity to the network (the number of PCs) is a key requirement. Not only has this grown in numbers in recent years to the current estimated world-wide total of 140 million PCs, but it is expected to further increase to 1,000 million by the year 2005. The costs of connection are dropping rapidly. Two laws drive them.

- The first is Moore's Law (from the head of Intel), which says that the number of transistors etched onto a computer chip doubles every 18 months – a tenfold increase in processing power every 5 years. This is a strong drive for everyone to be able to afford powerful IT equipment.

- The second is Gilbert's Law, which suggests that bandwidth is doubling every 9 months. Though the last mile may still pose the problem in access from the home, the growing bandwidth available within university sectors and corporate intranets allows even more varied data resources to be included within the download capability of the new computers

(b) open standards have to be created and adopted to ensure that the metadata is uniform and accessible. This is even more profound than connectivity. The rapid emergence of universal technical standards for communication, which allows everybody to communicate with everybody else at essentially zero cost, constitutes a major change. Gone are the days of proprietary standards, which essentially limit access.

Different economics

The consequence – and this is the important issue – is that those services which deal with metadata itself operate with different economics from those dealing with the main product. They tend to follow Internet rules of behaviour. For example it has become a sine qua non that aggregators of metadata offer access to the metadata free of charge. Their economics rest on the generation of revenues from other related activities, such as:

- advertising,
- transactional e-commerce (pay-per-view)
- offering premium services (customising the metadata)
- charging the supplier to be included in the catalogue

Another feature of the Internet is the vast amount of rubbish polluting the system. Merely to offer vast amounts of aggregated material as a dumping zone for journal publishers is not serving the best interests of end users.

To address this, another concept has been added to the aggregators' armoury – that of 'navigation'.

Navigation

In their various publications Ernst and Wurster emphasised the need for 'navigators' to make sense of the vast amount of unrelated material spewing out from all quarters, not least from the scholarly communication process.

The availability of this "information" or metadata is creating a new type of service. It has sponsored the rise of the navigators. Lycos, Altavista, AOL et al mine for such information items and offer a service of comprehensive access to a user base. Many view Amazon.com as an online bookseller, but its real business is navigation, not just of books, but of CDs, toys, films and drugs.

These navigators are more proactive in identifying and meeting end user needs than has been the case with earlier forms of intermediaries. Navigators have become a separate business. Navigation and selection on the Internet occur independently of physical warehousing and distribution. "Navigation is the battlefield on which competitive advantage will be won or lost."[3]

Scholarly publishing is witnessing the emergence of several such navigators. ingenta is one example; its aim is to reach as far into the Internet as possible with free catalogue entries from those publishers recognising the broader market potential offered by the Internet.

There are some essential ingredients to a navigation service in STM information:

- Offering simple, easy-to-use, intuitive search and retrieval systems is a must
- Providing access to a critical mass of material is a further necessity
- Offering continued technical enhancements and service support, not only of journal articles but also related services
- Creating new markets by promoting the site as a one-stop shop for all scholarly material

Reach, richness, affiliation

This has introduced the concept of 'Reach versus richness'. Reach – the ability to get the message through to the greatest number of readers – has traditionally been in conflict with 'richness' – offering quality or in-depth information. Traditional businesses saw a standoff between reach and richness – in the world of the Internet this is no longer the case. An e-business can provide a wide basis of customers (reach), with access to a broad range of products (also reach), and detailed information about each product (richness), whilst also collecting large amounts of data about the customer (richness). The Internet has made redundant the trade off between reach and richness.

However, the navigators additionally need to:

- accentuate the quality of information from all sources

But this comes with a third element – affiliation. Traditional intermediation (the subscription agents) has been focused on satisfying the two main stakeholders in the scholarly communication process – publishers and librarians – and was in tune with their needs.

In contrast, the Internet is all about attracting and keeping the loyalty of the consumer – the reader, the scholar, the researcher, the professional worker. Affiliation has moved, in the Internet context, to serving the needs of the end users directly. By doing so, a new robust market is offered to publishers.

Whilst the librarian has been the key in the past, under the Internet the end user is enfranchised. The web service switches its allegiance from the suppliers to the customer, offering customers all the information they need to make a personal choice. This may be in conflict with the interests of a particular supplier included in the catalogue. But so be it. Customer loyalty is a key requirement of the successful navigator.

Here it becomes contentious. Perhaps the player in the worst position to exploit affiliation is the product supplier or publisher because, by definition, the supplier has an interest in the transaction that is different from the user's.

Richness can be developed by navigators in the area of consumer information – collecting data about how people have used the service in the past and how their interests can be served in the future by providing them with newly published information. It is the basis for building a relationship with the customer. Privacy and the wishes of users to search for information themselves may constrain this, but in general the ability to build up a profile of the researcher's needs can be a powerful tool in the development of customised and personalised services.

Serving the 'active user'

Navigators are in essence serving a new kind of end user. To quote Lorcan Dempsey (director of DNER), there is an 'active' user of information. At one and the same time a researcher is also a teacher, a conference attendee, a reviewer, a journal referee, an editor, a parent and possibly a tennis or football fanatic. This gives tremendous scope for the new-age 'navigators' to present users with new types of information, packaged in different ways, to meet these various and sometimes conflicting needs and hobbies at the appropriate time in the appropriate way.

New information services and packages

There is strong evidence that research articles are only one small portion of the information needs of the research community (one part of the 'active user's' requirement). With the digital revolution has come a plethora of other information sources that can be accessed before the relevant research is published. From bulletin boards, through

e-mail, to e-print services and onward to accessing genome sequences, crystallographic data, census information, to patents, standards – these are the new online resources open to the researcher in the new Millennium.

The mechanism for enabling such external resources to be meshed in with the formal publications is 'linking'. The ability to click from a reference in an article to a remote file, where moving and still images provide supplementary data, is no pipe dream. The ability to link from a patent application to the research articles on which it draws is a reality. Linking from articles to articles in other publishers' sites has been a phenomenally successful development of the STM publishing scene through the CrossRef process. But all these are only part of the picture.

Open standards are still required to make linking effective. The International DOI Foundation has been doing sterling work, under Dr Norman Paskin, to create registration agencies for a range of new information types – not just journal articles, but for images and e-books as well.

ingenta has developed just such an expansionary view of the needs of researchers and currently offers links to a number of external and free information systems in support of the journal article. Bibliographic databases (A&I services) have long been linked to via BIDS, the predecessor of ingenta, and now free links are offered to patents, funding information and, soon, to conferences and a whole host of additional services. These links are being made at the broad subject level.

The new business rules

Recent studies all point to the differences between what was appropriate business practice in the traditional publishing economy and the procedures that are appropriate in a burgeoning new economy. Some of these new rules have been identified and summarised by Kevin Kelly.[4]

The New Rules for the New Economy

1. Embrace the Swarm (recognise the power of decentralised control)

2. Increasing Returns (networking on the Internet increases activity geometrically)

3. Plentitude not Scarcity (value is increasingly in abundance, not in perpetuating scarcity)

4. Follow the Free (generosity begets wealth; anticipating ever reducing prices the key is to win the attention of the only scarce resource - end user's attention)

5. Feed the Web First (distribute as much free information to feed the web)

6. Let Go at the Top (be willing to recognise that obsolescence is inevitable, and let go before it's too late)

7. From Places to Spaces (the network space offers opportunities for intermediaries to satisfy new needs)

8. No Harmony, all Flux (as fluctuation and instability becomes the norm, innovation will be crucial rather than planning)

9. Relationship Fostering (the end user loyalty has to be won and nurtured)

10. Opportunities before Efficiencies (productivity is the wrong thing to care about in the new economy)

(see "New Rules for the New Economy – 10 ways the network economy is changing everything", Kevin Kelly, 1998)

Several of the above are specifically appropriate to the scholarly information sector.

Increasing Returns. As the number of connections between people and items are aggregated, the consequences of this network of complex connections multiply even faster. This is different from economies of scale because the latter increase gradually and linearly – increasing returns in a network situation expand geometrically because of the web of relationships which build up.

Feeding the Net. The new intermediaries have to 'feed the net' – offer information, metadata and content – for free. It is part of the Internet practice that no one pays for data. The separation of 'metadata' from 'stuff' helps the intermediaries in this respect. In order to become part of the most used Internet club, the net must

be fed with as much free information as possible as a matter of corporate policy – to get one's name out there, to become one of the most used sites. It is one of ingenta's notable achievements that it is in the top 20 most used UK web sites. Part of this is due to the free databases that ingenta is making available to attract the scholar and researcher.

Premium Services. Commercial activity is earned from offering 'premium' services which the end user needs and would be willing to pay for. But there must be a clear and personally accepted addition of value to be gained from subscribing to such premium services.

Let Go at the Top. If the current model is not working, abandon it. No product can stay ahead of the market for long and there is no new process that cannot be replicated, often with improvements, by the competition. Only organisations that recognise this, and can turn the concept of continuous innovation into reality, are going to succeed. This may involve de-construction of what is currently successful in anticipation of a new competitive system.

This process of deconstruction at the top is difficult but essential if a business is not to be left behind by organisations recognising the existence of a new business opportunity. The classic example in our industry is Encyclopaedia Britannica. They failed to recognise that their business model of selling expensive volumes could not compete with Microsoft's almost free Encarta; they almost went out of business in learning the lesson.

As innovation accelerates, abandoning the highly successful in order to escape from its eventual obsolescence becomes the most difficult and yet most essential task. There will always be a new mountain that threatens to put one's own into the shade.

No Harmony, all Flux. The Internet is a volatile creature, constantly in motion and under development. It allows no time to sit and think. It demands immediate, instantaneous responses. Change is both a challenge and a threat. The latter was pointed out by Spencer Johnson in the cult US book entitled, *Who moved my Cheese?*[5], which describes how the change created when a store of cheese was moved in a maze affected four different personality types (described in terms of mice and small humans). The test was

to see how many of the character traits could be identified by people in organisations.

Such radical change is not new. It has been a recent phenomenon of the electronic information intermediary business, as described in 1996 in the UKSG/JISC study[6]. How soon such changes will come into effect is difficult to estimate. Will banner advertising be revitalised, will premium services take off, will e-commerce (pay-per-view) become a key earner within the next six months or six years? These are still unknown.

Future developments

What of the future? There are signs of more customisation of information requiring expertise in selection of the relevant over the irrelevant. This is particularly the case where different subject specialists are involved. Physicists are completely different from medical specialists in their information needs. One can stress access to e-print services as being the primary requirement for information, the other can be more reliant on formalised publications.

The ingenta institute, a not-for-profit research centre, explored some of these differences at its meeting in 1999, and a direct result of this has been ingenta's focus on developing information for broad subject areas. Equally, the rise of the portal concept has created the concept of scholars and researchers being separate communities, each with different ways of handling information. ingenta has created an e-community programme which, together with editorial partners in the societies and publishers, is creating the technical template to allow such community information exchange to take place.

One-stop centres for all the information needs of researchers will emerge, and it may well be the new navigators who take on the task of meeting the technological challenge which the creation of multimedia, multi-format packaging of linked information services will demand.

All this will require the traditional business model to be revisited. If the new knowledge workers are to be the focus of the new electronic business of the future then the old subscription model is no longer tenable. E-commerce and advertising may become important, but only if greater critical mass (in content and users) is achieved. It is a numbers game.

Conclusions

The essential function of the new intermediaries is to reach new markets in whatever ways possible.

If they can do this, they can offer publishers an incremental market for their articles at no cost to them.

Longer term, they may thereby achieve the socially laudable endeavour of democratising information on a global basis.

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