

# Disruptive technologies: taking STM publishing into the next era

Publishers today face a world of ‘unprecedented uncertainty’<sup>1</sup>. The web, Google, social networking, wikis, blogs, RSS Feeds – technological innovation has and will continue to impact all aspects of our business and the way we interact with our customers. But with scientific information freely available and accessible on the Internet, can traditional publishing survive? Indeed it can. While publishers have achieved a great deal using a traditional publishing model, we must now increase our level and speed of innovation to compete in today’s technology landscape. We can do more than just survive – it is in fact an incredibly exciting time for the industry. The key to success and the challenge ahead lies in harnessing the openness and collaboration today’s technologies present for the benefit of the scientific community and in adapting to our customers’ new types of demands.



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## Defining disruptive technologies

A ‘disruptive technology’, according to Wikipedia (itself a good example of disruptive technology), is a ‘technological innovation, product, or service that eventually overturns the existing dominant technology in the market’. Specifically, ‘a disruptive technology comes to dominate an existing market by either filling a role in a new market that the older technology could not fill ... or by successively moving up-market through performance improvements until finally displacing the market incumbents’.<sup>2</sup>

The concept of disruptive technologies and their impact on business activities came to the fore when Clayton Christensen, a professor at Harvard Business School, wrote *The Innovator’s Dilemma* in 1997. Christensen stated that the eternal dilemma faced by firms in any competitive marketplace is continual innovation. Inevitably, firms that succeed in one generation of innovation become undermined by their own success and therefore are doomed to lose out in the next wave of innovation<sup>3</sup>. Just as they ‘disrupted’ the previous era’s leaders, they are in turn disrupted by the pioneers of the next.

Christensen identified two key forms of innovation – sustaining innovation and disruptive innovation. Sustaining innovation improves the performance of existing products to grow profits and satisfy the needs and wants of a company’s most profitable and most demanding customers – something also known as adding ‘bells and whistles’. When a new player enters the market, the incumbent firm will typically prevail.

However, there comes a point when consumers lose their appetite for the growing number of bells and whistles being added to core products. This is where disruptive innovation comes in. By targeting the least demanding customers, or even creating completely new markets, disruptive technologies offer a simpler and often cheaper alternative. Christensen warned that in disruptive technology battles, newcomers to the industry almost invariably ‘crush the incumbents’.<sup>4</sup>

Why does this happen? There are two key reasons. First of all, an asymmetry in financial incentives exists. A disrupter sees new markets where the incumbent sees marginal or unprofitable business.

The disrupter continually innovates until its product or service is performing well enough to poach the incumbent's main market. Christensen suggested the second key reason new entrants prevail is down to the "cultural malaise that infects incumbents."<sup>5</sup> In other words, big, successful companies look at products and competitors. Disrupters look at real people and what they need.

Many traditional scientific, technology and medical (STM) publishers are currently in the sustaining innovation phase – trying to sell ever better, more profitable products to their most attractive and demanding customers; adding bells and whistles to existing technology.

The direction Elsevier is taking, and the way forward that we would suggest for all publishers, is to become our own disrupters, and develop the new technology platforms that will push STM publishing into the next era.

### Technology today

When the world wide web became mainstream in the mid to late 1990s, publishing was turned on its head. The web has provided a communication, collaboration, dissemination and innovation platform like no other.

With the web came Google. Inarguably, Google, along with other search engines, is the leading disrupter of the publishing business. Google has changed the game for journal publishers and scholarly researchers by enabling free and easy access to information on every topic imaginable.

Google aside, the popularity of the web has given rise to many other technologies that connect people with mutual interests and come under the umbrella of 'social networking'. Web logs (or blogs), for example, provide a great platform for people to share their experiences, knowledge and insights. From March 2003 to October 2006, more than 57 million blogs have been tracked, and more are being created every day. Online forums are another medium that enable thought sharing and discussion on the most niche subject areas.

The rise of this social networking means that customers are now creating the content, not just consuming it. Anyone has the ability to publish on any topic they desire on the web. Peer review, as we know it in the world of academic publishing, does not exist. There is a wealth of excellent information available on the web, but there is also

a lot of what we call 'junk science' – unverified data from unqualified sources.

In the STM community, the social networking phenomenon is termed 'open science' and has enabled researchers and scholars to provide comment and reviews online in real time, allowing for far more collaboration than ever before. This openness is a positive advancement for science – we simply need to develop the processes and platforms that enable us to harness this effectively.

### Publishing's response to the technology boom

Those of us who have been in scholarly publishing for the past 25 years or more have seen a lot of change and we know innovation is an ongoing process. The question is: how do we stay ahead of the game? In the 1970s and 80s we were in a period of exploration. In Elsevier we called it the 'let a thousand flowers bloom' period – try a lot of things and see if any work.

In the late 1970s a group of STM publishers started looking seriously at electronic dissemination in a project called ADONIS. The idea was to scan and store journal articles on optical disk for print on demand. However, the technologies of the early 1980s were too expensive, and it was only later, with the spread of personal computers and CD ROM, that the ADONIS project became a reality in 1991. While ADONIS thought it could ride the wave of the new technology, CD ROMs were soon understood to be only a detour on the way to online delivery and a system such as ADONIS, which relied on CD ROM, became quickly obsolete.

By the 1990s the goal was clear: move journals from paper to electronic distribution as smoothly and efficiently as possible, and TULIP was the next major project at Elsevier – experimenting with the delivery of scanned journals over local area networks, using locally developed software. In 1991 we partnered with nine university systems, involving 17 universities in total. The idea was that each university would develop its own software to use the journals, and that process proceeded with varying degrees of success. At the same time, Elsevier was experimenting with using the Internet as a way to deliver large scanned files to the universities. It was a challenging process to say the least – at peak delivery times we constituted five percent of Internet traffic. However, in 1993 Mosaic

was introduced – an easy, common browser approach. While this changed the focus of development post-TULIP, there were many invaluable lessons learned surrounding technology and user behaviour from this experimental project.

Immediately after TULIP (1995) we started commercial developments, first with local installations (called now ScienceDirect OnSite) and then with a web-based online platform, ScienceDirect. Today, ScienceDirect has just celebrated its billionth download and boasts more than 8 million articles and over 10 million regular users accessing full-text articles from some 2,000 scientific, technology and medical journals. Although we were still learning what the web was all about, ScienceDirect succeeded because it was able to make use of a high-speed, inexpensive Internet connection, a local environment of ubiquitous personal computers and printers and a common browser, removing the need for local installation of software.

Publishers have learned that the key to making a success of any electronic product is simple – make it easier for someone to do something they have to do anyway. We forget this at our peril. If we get too far from our customers' needs, we risk being displaced.

Publishers understand that for our future survival we need to know, not guess, what our customers need. This is why at Elsevier, for example, we have formed a User-Centred Design Group, putting this at the very heart of new product development. This team designs in a way that the user instinctively understands how to use the product.

A recent example of this user-centred design is Scopus, a navigation tool covering abstracts, references and indexes of STM literature. Scopus was designed using a true customer-centric methodology. Teams were out in the field continually testing. They would then go back to the lab, adjust the design in line with user feedback, then go out and test again. The result? A product that users like. We have learned the most important lesson in surviving in the age of disruptive technology: know and honour your customer.

### **What does the future hold for STM publishing?**

Indeed, the Internet has changed the landscape for all publishers, enabling authors to post papers

directly to their own websites and their institutions' websites (including their institutional repository). This 'self-archiving' means some reader traffic has moved from the publisher's site to the author's. How much? Will this jeopardize subscriptions? We do not know yet – the jury is still out.

STM publishers are now focused on leveraging this unprecedented level of openness and information sharing. We no longer think of this technology as 'disruptive' – rather, it is an opportunity to grow and develop in ways never before conceivable, which has exciting implications for the scientific community. At the most basic level, for example, we at Elsevier have been working with Google and Microsoft to ensure our articles are fully indexed and therefore searchable on these services. If our customers' first port of call is a large consumer search engine, or a speciality vertical search engine, then it is our responsibility to make sure our content is discoverable there.

Exciting innovations come through embracing 'open science' and adapting to change. There have been several 'open science' test runs in STM publishing, but to date, none has seen any significant user traction. STM publishers are persevering however, and will continue to apply the lessons learned from these trials until they develop a workable solution.

For many large publishers, this means a shift of focus from being an information provider to a knowledge and insight provider, a partner that improves the productivity of the researcher and student. For example, behind every research paper exists a large amount of important data that often goes unpublished. How can we ensure this data is not lost to the scientific community? What platforms can be developed to secure this information for future generations of scientists and researchers? Is there a role for publishers here or for libraries – or for both acting together?

Another key question facing publishers is how can we deliver value-added information to our customers? Anyone can search for information and receive lists and lists of results, but by developing software that delivers smart searches and true insights that enable our authors and researchers to do their work more effectively and efficiently, we hope to ensure that we remain a valuable partner to the academic and scientific community. It is where the future lies for STM publishers. To achieve this, we must grow openly with our customers and get them involved in every phase of

product development, to ensure it meets their needs.

While the challenge ahead is indeed significant, it is an exciting time for the publishing business. We have before us the opportunity to provide an unprecedented level of collaboration and information sharing to the STM community – which can only be seen as a positive step towards the advancement of scientific discovery worldwide. To do this, we must not be afraid to disrupt our own businesses, because if we do not, someone else will.

## References

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