

Digital information world: what difference can we make?

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ABSTRACT

Traditionally library and information services have played an intermediary role connecting information creators and information users. Recent developments in ICT (information and communication technologies) especially the Internet, web and mobile technologies have brought significant changes in the information industry as well as the information services sector. While these new technologies have brought many opportunities they also have brought new challenges for the information services sector. With the emergence of many new digital information systems and services, as well as a myriad of new digital information channels and service providers, it has become apparent that the information profession now needs to find some ways to improve their services and to make their presence felt in the digital information world. This paper proposes some new areas of research and development activities that the information professionals need to undertake in order to make optimum use of the emerging digital technologies for providing better information services.

Keywords: Digital information; Digital information access; challenges

INTRODUCTION

The information industry and the information services sector have for centuries played a key role in the knowledge continuum. Together they have linked information creators and information users and in that process they have played a big role in the use of existing knowledge and also in the creation of new knowledge. However, this scenario has changed quite dramatically over the past two decades with the rapid developments in ICT (information and communication technologies), web and mobile technologies. In today's digital information world, creation of information – all the activities associated with the creation, publication and distribution of content and data – is no longer within the sole control of the information industry – traditional publishers, aggregators, distributors, database services, etc. The web has created new opportunities for creation of digital content and data, and virtually everyone can now be a publisher and distributor of information. Many new fee-based as well as open access content is now created and made available through the web providing opportunities for users to access content from what looks like an online content marketplace. Traditional library and information services are not the only channels for getting access to information in today's world. In fact, the traditional information services sector is now being challenged in almost every sphere of their activities by a variety of new players ranging from a myriad of commercial eBook services like Amazon to search engine services like Google, Google Books, Google Scholar,

Microsoft Research, and so on. So, the vital question that challenges the very existence of the information profession is: what difference can we make? Why should people come to the traditional library and information services, and more importantly what can the information professionals offer that makes their services better than those that are available elsewhere? What can we do to design and deliver digital information services that are socially, economically and environmentally sustainable? This paper aims to address these questions. In order to find an answer to these questions, it first looks at the current state of digital information with a view to identifying the various stages in the information lifecycle where information professionals can make a contribution. It proposes some areas of research that can help information professionals create better and sustainable information services.

DIGITAL INFORMATION CREATION

In Britain the publishing industry has a turnover of over £18.4 billion, with its 8000 plus companies employing around 164,000 people and contributing to over 8% of GDP (BERR, 2009). Another study (Houghton et. al, 2009) shows that in 2007 the core scholarly publishing system activities may have costed around £5.4 billion in the UK. The global value of the publishing industry is estimated to be “€80 billion and is the second largest creative industry in the world, after television; and is currently bigger than the music publishing; video games and entertainment software; and audiovisuals (DVDs and downloads) industries combined” (Ogunlesi, 2011).

Although commercial publishers have remained at the forefront of publication and distribution of content, especially scholarly content, increasingly digital content is being created and distributed by many non-conventional publishers – individuals as well as institutions. A variety of alternative models for accessing knowledge have appeared over the past few years and they operate under different business models (Bunkell & Dyas-Correia, 2009; JISC, 2009a; JISC, 2009b; Nicholas, et.al., 2010; Pool, 2010; Chowdhury, 2011). Many new players and special information services have also appeared in the knowledge sector, typical examples being Google Books, Amazon, Apple, etc. Nowadays, authors can also choose to self publish their books quickly without having to go through a formal publisher. For example:

“CreateSpace, a member of the Amazon group of companies, provides a fast, easy and economical way to self-publish and make your content available to millions of potential customers on Amazon.com and other channels” (Amazon, 2012).

Similarly, the Kindle Direct Publishing (KDP) option provides opportunities for publishing books with Kindle. According to the Kindle site, Quick Publishing takes less than five minutes and the new book usually appears on the Kindle store within a day (Amazon, 2012)

Open access publishing has also become quite popular over the past two decades. The open access movement emerged in the early 1990s with the establishment of the open archive arXiv.org in order to provide free access to literature on high-energy physics, and later it became more inclusive covering other subjects like mathematics, statistics, etc. The Santa Fe Convention in 1999, and subsequently the Budapest Open Access Initiative (BOAI) in 2001, brought a new era in open access communication (Cullen & Chawner, 2011). The

costs and benefits of open access publishing models are discussed widely in literature (Houghton, et.al., 2009; Houghton, 2011).

One of the most significant outcomes of the open access initiative was the establishment of institutional repositories. The first institutional repository in the UK being set up in Southampton in 2001 (Cullen & Chawner, 2011) and first one in the US was set up at MIT in 2002 (Lynch, 2003). An institutional repository may contain the intellectual output of an institution – research and teaching materials as well as experimental and observational data – and also documentation of the activities of the institution itself in the form of records of events and performance, etc. (Lynch, 2003). The OpenDOAR database records a significant worldwide growth in the number of repositories over the past six years, from just over 300 in mid-2006 to over 2000 by August 2012. Typically these repositories hold a mix of journal articles, theses and dissertations, unpublished research reports and papers, conference papers, books and book chapters as well as multi-media and other audiovisual materials. The development of institutional repositories however has not been uniform throughout the world. Cullen and Chawner (2011), report that nearly three-quarters of institutional repositories are in North America (24%) and Europe (45%), while there are only 17% in Asia, 6% in South America, 4% in Australia, and only 2% in Africa. In the UK, JISC has been playing a key role in promoting the development, management and use of institutional repositories (Jacobs, et.al., 2008, JISC, 2011a; JISC, 2011b; JISC, 2011c).

In addition to the formal channels for scholarly publications, the web has created an enormous opportunity for creation and sharing of data and content that is purely user-generated. Such data and content may be created by anyone, and they do not go through the formal publication process and are not peer reviewed. Nevertheless, such content has been growing very rapidly over the past few years and have become extremely popular. Here are some mind-boggling statistics from YouTube:

- “Over 800 million unique users visit YouTube each month
- Over 4 billion hours of video are watched each month on YouTube
- 72 hours of video are uploaded to YouTube every minute
- 70% of YouTube traffic comes from outside the US
- YouTube is localized in 43 countries and across 60 languages
- In 2011, YouTube had more than 1 trillion views or around 140 views for every person on Earth.” (Youtube’s Statistic)

And here are some statistics for Facebook traffic (Facebook’s Keyfacts):

- 955 million monthly active users at the end of June 2012.
- Approximately 81% of monthly active users are outside the U.S. and Canada.
- 552 million daily active users on average in June 2012.
- 543 million monthly active users used Facebook mobile products in June 2012.

Wikipedia is another popular example of user-generated, or what is also known as crowdsourced, content. Although such user-generated content are not managed by the traditional library and information services sector, most digital information services today use social networking technologies in promoting their activities. Some information services also allow users to tag and provide annotations to digital content, especially cultural heritage content, and such user-generated or crowdsourced data can add a significant value to digital content.

DIGITAL INFORMATION ACCESS

Access to digital information, especially scholarly information, is provided by library and information services through a variety of databases, eBook, e-journal and digital library services. Increasingly libraries are using shared subscription and access facilities for digital content. In many countries various national bodies and consortia have been formed for this. For example, in order to support the procurement of digital content for education and research in the UK, the higher education funding councils have created a membership organization, called JISC Collections that provides efficiency gains to the members of approximately £50 million per annum (JISC, 2012).

With the growth of institutional repositories some specific services are being developed to facilitate access across a range of repositories. For example, in the UK JISC has developed a service called CORE (CONnecting Repositories) that can be used for full text search of items held in 142 approved Open access repositories (JISC, 2011c). Similar initiatives are also available elsewhere, e.g. the DRIVER project (Peters & Lossau, 2008) whose objective is to establish an appropriate infrastructure for all European and world-wide digital repositories, thereby providing scientific information in an open access model. New tools and protocols like SWORD (Allison, et.al., 2008; Lewis, et.al., 2012) have emerged in order to facilitate the interoperable deposit of resources into repositories. Services like OpenDOAR allow users to search across all the institutional repositories, currently over 2000. These new service provide free and one-stop access to the scholarly output of hundreds of institutions.

Individual users can also access digital publications through membership subscriptions like those of ACM (American Computing Machinery), ASIST (American Society for Information Science and Technology), etc. There has also been a significant growth in the use eBook market. In 2011, the overall trade revenues for books in the US was \$13.97 billion, an increase of 0.5% from the previous year, while e-book revenues jumped to \$2.07 billion, or about 15% of the total (Grenfield, 2012). Compared to the previous year, \$1.2 billion in revenue shifted from print books to e-books.

There has also been a significant development in the Google Book services. People can now search millions of eBooks through this service, and once they find a book they can either purchase it through the Google eBookstore or can find the book in a library. Through specific services like Google Scholar people can search for scholarly publications – books, journal and conference papers – and access the retrieved items from the listed source or through libraries. Google Scholar also provides other value-added services by providing citation data. Some services, like Microsoft Academic Search also shows the growth of research in the chosen field.

Users can also access digital information through a variety of digital libraries. Examples of large digital libraries of open access scholarly information includes arXiv (<http://arxiv.org/>), NSDL (National Science Digital Library; <http://nsdl.org/>), NDLT (Networked Digital Library of Theses and Dissertations; www.ndltd.org), NCSTRL (Networked Computer Science technical Reference Library; <http://www.ncstrl.org/>), etc. Similarly, there are numerous other digital libraries that provide access to specific types of materials, for example, the Europeana digital library (www.europeana.eu) for access to cultural heritage information, and digital libraries of various national libraries, archives and museums, etc.

CHALLENGES

So far we have noted that in today's digital information world, digital content and data is created and distributed through a variety of different channels, and users can access such digital content and data through a variety of services, some of which are provided by traditional library and information services, while many others can be accessed through various non-library services. Furthermore, many digital information services can be accessed for free – for searching as well as for accessing information. So, the question remains: do these developments bring opportunities or threats for traditional library and information services, and more importantly what can information professionals do to make a difference in today's rapidly evolving digital information world. The following sections are devoted to finding answers to these questions.

Economic Challenges

As discussed earlier in this paper, the commercial publishing industry makes a substantial contribution to the economy of many countries. Nevertheless, there is also a significant growth in the open access initiative resulting in numerous open access journals, books, digital libraries and institutional repositories. While these developments will obviously bring some changes in the creation and distribution of knowledge, it is unlikely that the commercial publishing industry will be totally replaced by open access publishing. It is most likely that both will exist side by side and will complement each other by providing better access to knowledge on the one hand, and facilitating the creation of new knowledge on the other. The question is what role can the information profession play in making this happen?

Many recent studies (Cullen & Chawner, 2011; Connell, 2011; Cryer & Collins, 2011; Davis & Connolly, 2007; MacDonald, 2011; Jean, et.al., 2011) point out that the progress of institutional repositories has not been as great as was originally envisaged. One of the main reasons for this is the lack of proper and acceptable evidences of better citation and academic rewards resulting from institutional repositories. This in turn causes another challenge facing the development of institutional repositories, i.e. a continuous funding support. LIS professionals can play a major role here by generating different kinds of usage statistics and citation analysis data. They can generate reliable figures showing the evidences of better usage and better citation of open access content.

LIS professionals can play a major role in integrating research data and content so that users can get access to data and content seamlessly for understanding of research, reproducing research studies, and generating new research based on existing datasets, research methods and findings. Such novel tools and technologies will promote better research and scholarly activities which will promote further knowledge creation. This on the one hand will show the importance and thus will secure funds for institutional repositories, and on the other hand it will facilitate new knowledge creation which will promote the commercial content industry.

Environmental Challenges

It is estimated that ICT's own sector footprint currently stands at 2% of global GHG (greenhouse gas) emissions and it will almost double by 2020 (The Climate Group SMART2020, 2008). Digital information systems and services make extensive use of ICT

infrastructure and equipments and thus make a significant amount of GHG emissions. In 2010 Google's overall consumption of electricity was reported to be 2.26 million MWh (Albanesius, 2012) which is equivalent to emissions from about 11 average power stations in Britain (Chowdhury, 2012a). Another estimate shows that about one billion Google search is conducted every day, and thus even on a conservative estimate, one billion grams or 1,000 tonnes of CO₂ is emitted only for Google search every day (Gombiner, 2011). Another study estimates that the Internet consumes between 170 and 307 GW (GigaWatt) of electricity which is equivalent to 1.1–1.9% of the total energy usage of humanity (estimated to be 16 TW (terra watt)) (Reghavan & Ma, 2011).

It is estimated that the higher education institutions (HEIs) in the US produce approximately 121 million tonnes of CO₂ (carbon dioxide) in a year which is equivalent to nearly 2% of total annual greenhouse gas (GHG) emissions in the US, or about a quarter of the entire State of California's annual emissions (Sinha, et.al., 2010). In 2008-2009, UK HEIs used about 1,470,000 computers, 250,000 printers and 240,000 servers; the IT-related electricity bills to run these equipments was estimated to be around £116m; and it was estimated that the electricity used to run these ICT equipments would generate 500,000 tonnes of CO₂ per annum (James & Hopkinson, 2009).

So, what can the information professionals do in this area and how can they make positive contributions in saving the earth? Studies show that use of modern technologies like the cloud computing, can reduce both the economic and environmental impact of digital information (Chowdhury, 2012b). In the UK, the Joint Information Systems Committee (JISC) is promoting the idea of using the cloud computing technology for providing data and information access services for the HE sector in the country. Such new technologies can reduce the environmental costs of information services and at the same time help HEIs save money from reduced ICT infrastructure and reduced energy costs (JISC, 2011d; JISC, 2011e; JISC, 2011f). Some universities in the US are also taking similar initiatives in developing cloud-based systems for managing research data and information. For example, the Computation Institute at the University of Chicago and Argonne National Laboratory are working to develop a system called *Globus Online* "to implement data management logic, both Amazon and local storage, campus credentials for authentication, and a set of UChicago and Argonne researchers and their laboratories (both small and large, and from a range of disciplines) to evaluate effectiveness" (Foster, 2011). In The Netherlands, SURFnet, the national body for promoting ICT in education and research, is also taking several measures for promoting the use of cloud computing for HE and research.

So, there is a push for moving data and content to the cloud, because cloud-based information services can bring several economic and environmental benefits (Chowdhury, 2012a; Chowdhury, 2012b; JISC, 2011d; JISC, 2011e; JISC, 2011f) However, a number of social and user related issues are associated with cloud-based information services; and this is where the information professionals can play a major role. For example, there is a need to study the various information access and management issues related to integration and use of research data and content; study of information behaviour as well as various institutional and user culture and practices in relation to access and use of digital content and data, and so on. To date no research has addressed these issues in the context of digital information systems and cloud computing technologies (Chowdhury, 2012a; Chowdhury, 2012b).

Social (Service-related) Challenges

Given the rapidly changing landscape of digital information systems and services, and the associated economic and environmental challenges, it is imperative that the digital information services of today and tomorrow be socially sustainable, and this is where the library and information professional can play the most important role. For several decades information researchers have studied human information behaviour (HIB) that resulted in several models for generic and specific (context-specific) information behaviour of users, and also many information seeking and retrieval models (Wilson, 2009; Ingwersen, 1996; Ingwersen & Jarvelin, 2005). These models have on the one hand helped information professionals better understand how people access and use information and on the other hand they have helped the information services sector develop more efficient and user-centric information systems and services.

NEW DIRECTIONS FOR RESEARCH AND DEVELOPMENT

In the emerging digital information world, information professionals should focus on the following areas of research and development activities that will help them develop sustainable digital information systems and services.

- Design and development of user- and context-specific services: While search engines takes a 'one-size-fits-all' approach and offer a generic search solution, information professionals have long been engaged in providing user- and context-specific information services. There is now a steady shift in digital information environments from information search to information discovery within a specific user, institutional and cultural context. Information professionals can play a major role in developing user-, context- and culture-specific information services.
- New user-centric tools and technologies for better access and use of digital information and data: In the emerging global digital information world, more user- and context-specific access and usability features need to be added on top of the generic interface in order to support better discovery of information. Managing research data and its integration with scholarly content also remains a major challenge (Borgman, 2011; Giglia, 2011). Cultural, political and linguistic variations play a prominent role in the development and use of open access information. In order for the open access information services to succeed, a variety of local needs, local culture and standards need to be adopted within information systems (Borrego & Fry, 2012).
- Digital/information literacy: One of the major challenges of the emerging digital information world is related to the social inclusion/exclusion. Digital divide that creates a gap in our society based on peoples' access to, and use of, ICT and Internet, manifests itself in access to, and use of, information for different day-to-day activities and for better living. Information professionals can play a big role in bridging the digital divide and promoting social inclusion by developing and imparting appropriate digital literacy and information literacy training programmes. More research is needed for developing better, user-centric and context-specific information literacy programmes.
- New tools for measuring the use and impact of digital information: Information professionals have long been engaged in developing tools for measuring the use of information, and measuring the quality of research. This is becoming increasingly important in the global competitive marketplace for education, research and scholarly activities. Various countries are now using such measures nationally to assess and rank

the quality of research at the universities, for example, REF (Research Excellence Framework in the UK), and ERA (Excellence in Research in Australia). New measures of usage, quality assessment and impact have to be developed in order to promote and measure the impact of digital information services.

- New opportunities for knowledge creation and sharing: Web and social networking technologies have opened up several new opportunities for creation and sharing of knowledge amongst selected people and peer groups (Banciu, et.al., 2012). New research is needed for developing appropriate tools and technologies for creation of new knowledge based on commercial as well as open access content and data. New systems and regulations are being proposed in some countries (see for example the Hargreaves Review (Hargreaves, 2012) and the Digital Copyright Hub (Hooper & Lynch, 2012) in the UK to support research in a shared online environment and also to support research in different areas, such as integration of content from a variety of channels and sources, generating various data analytics, etc. for promoting the digital economy.
- Ensure future access to content and data: One of the major requirements of a sustainable information service is to ensure present as well as future access to data and information. New and interdisciplinary research in digital preservation/digital curation, (Final Report, 2010; Chanod, et.al., 2012; SHAMAN, 2012) point out the various roles that information professionals can play in ensuring future access to information.

CONCLUSION

Internet, web and mobile technologies, coupled with the open access initiatives, have revolutionized the information industry and information services sector. These technologies have brought new opportunities for the content industry, content creators, users and information services sector. They have given rise to many new avenues for the creation, distribution, access and use of digital information. The new digital technologies have brought several opportunities as well as several challenges for the information services sector. In order to face the challenges and at the same time benefit from the opportunities provided by the emerging technologies, information professionals need to focus on certain specific areas of research and development activities. The new areas of research especially in relation to the social and service-oriented challenges of digital information services, identified in this paper, will enable information professionals make a change in the digital information world.

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