

# FUTURE TRENDS IN DIGITAL LIBRARIES AND SCIENTIFIC COMMUNICATIONS

**Murali M.**

Research Scholar

Dept. Library and Information Science

Bangalore University

Bangalore-560056

**Dr. K.G.Jayarama Naik**

Associate Professor

Dept. Library and Information Science

Bangalore University

Bangalore-560056

## Abstract

Development in R&D spending drives number of analysts and research movement. In Italy, R&D spending development is slower than worldwide normal, however is Italy is a very gainful research country. Enter drifts in investigate data incorporate more articles distributed because of more R&D spend and more scientists; quick development of open access over the previous decade yet remaining a little extent of aggregate articles distributed (7% out of 2012); expanded significance of non-article look into items, for example, datasets; utilization of different wellsprings of information to enhance examination and devices, bolstered by supercomputers and huge information methods. A wide assortment of members now bolster the scientist in his/her trip to make new information.

## 1.0 Growth in R&D spending drives number of researchers and research activity

Global expenditure on Research & Development (R&D) has consistently risen in real terms over many years. This includes both spending by companies and in academic and government institutions. This increase in spend has also resulted in an annual increase of nearly 3% in the number of researchers to almost 7 million (OECD), and a higher increase in the number of articles published of close to 6% in the period 2000 to 2012 (see Figure 1).

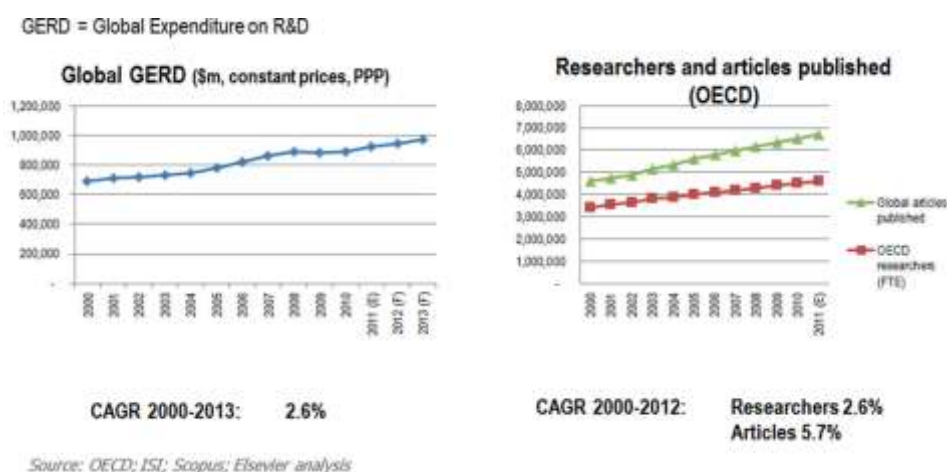


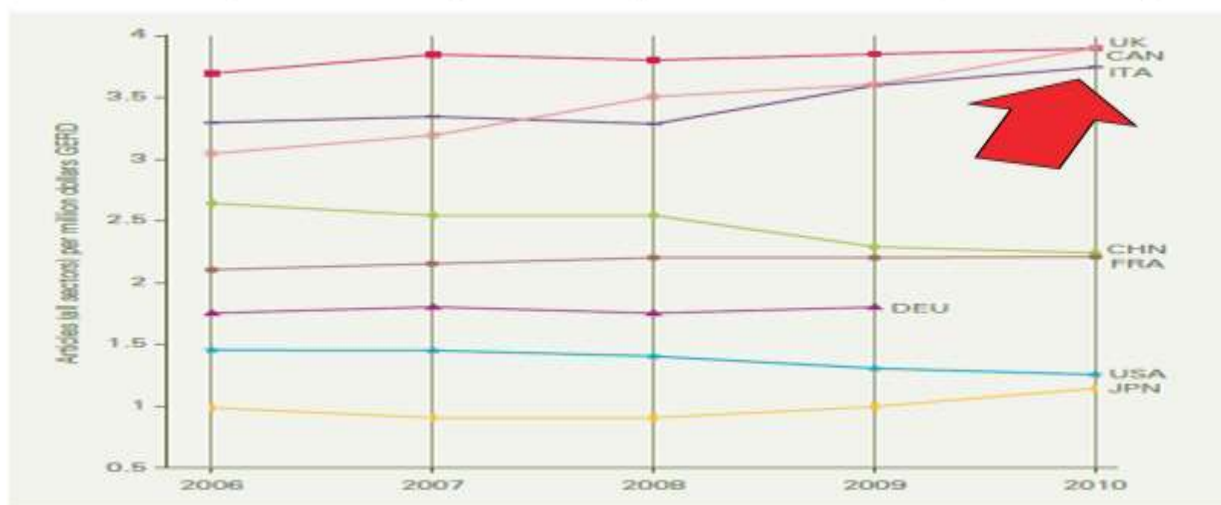
Fig. 1: Growth in R&D spending, number of researchers and research activity

## 2.0 In Italy, R&D spending growth is slower than global average, but Italy is a highly productive research nation

Expenditure on R&D in Italy has risen by a compound annual growth rate (CAGR) of 1.8% over the period 2000-13, which is slightly slower than average (source OECD, Elsevier analysis). The number of researchers has risen slightly faster than this at 2.7% from 2000-2012 (source: OECD, Elsevier analysis). However analysis

of publications by Italian researchers shows that Italy is a highly productive research nation in line with the UK and Canada, and Italy's productivity is improving over time (see Figure 2).

**Articles (all sectors per unit spend on GERD, 2006-2010)**



Source: UK BIS report; Elsevier analysis

**Fig. 2: Italy research productivity as compared to other major research nations**

### 3.0 Open access has grown rapidly over the past decade but remains a small proportion of total articles published (7% in 2012)

A key trend in scientific publishing has been the emergence of several forms of open access publishing. Analysis based on Scopus shows that the so-called “gold” open access route, where authors pay a publication charge to cover the costs of publishing, has grown rapidly to reach 7% of all articles published by 2012. The dominant model remains therefore the subscription route to publication. The “green” route to open access, where authors can post a copy of their manuscript or pre-print, has also grown over the same period. Uptake of the green and gold routes varies significantly by discipline depending on researcher preferences and levels of funding in each discipline.

### 4.0 Publishers have traditionally supported researchers in the publication process

Elsevier, like other publishers, invests in several areas to support researchers in disseminating the results of their research. Its role in the publication process includes facilitating and investing in peer review to improve research findings, enhancing research articles, providing access, and making them visible to readers, and guarding the integrity of research. Elsevier tends to publish more new articles every year, at steady or increasing overall levels of quality, as a result of the previously mentioned trend of increasing number of articles published globally. Elsevier also invests substantially in improving the functionality on its Science Direct platform in order to help researchers find the information they need. Furthermore publishers run a number of access programs to ensure researchers have access to high quality information, such as providing free ScienceDirect and Scopus access to reviewers, editors and post-docs, running Publishing Connect author training workshops, providing access for researchers in developing countries through Research4Life, and for patients through Patient Access programs.

### 5.0 Key trends in research information

There are a number of key trends emerging in scientific communications that have implications not only for publishers but also for digital libraries. These include:

- The increased importance of research objects other than the article, for example research data sets, or conference presentations. Considerable energy is being devoted by research funders to try to make data sets available for other researchers to use, while conference proceedings have become very important vehicles for communications in some disciplines such as computer sciences. Libraries can play a role in supporting researchers to meet funder requirements in areas such as data openness, as well as tracking and monitoring compliance with such requirements to support grant applications.

- Use of multiple sources of data to improve analytics and tools. Elsevier has had some success with improving search results by using signals from multiple sources of information about the searcher and his or her context. One example is the recommendation engine on the Science Direct platform. Such tools can improve the value obtained from existing library spend on various information sources. Libraries themselves also sit on multiple sources of data about their institutions and can create value for their institutions by combining these – for example by linking up researcher profile data with institutional repositories to showcase researchers' work.
- Use of supercomputers and big data techniques. The growing quantity of research information, together with information about user behavior, social network analysis, and other forms of data, can increasingly be processed using big data techniques to generate new insights and services to support researchers. An example of this is Elsevier's SciVal product which uses supercomputing and big data techniques to allow research managers to slice and dice in real time data about an institutions' performance compared to its peers. Secondly the increasingly computational nature of research is generating ever-larger data sets which need to be stored and analysed. In some institutions libraries are employing data scientists to work together with high performance computing centres and researchers to manage these growing datasets.
- Wide variety of players and providers supporting researchers. Information provision to researchers used to be primarily the domain of traditional publishers. More recently, a wide variety of technology providers, internet players, publishers, start-ups, and researchers themselves are connecting information and software to create a wider variety of tools that can be used across the research workflow, including for the planning and execution of research activities as well as the sharing of research outputs. The implication for libraries is that they increasingly need to act as a hub in the network connecting all of these to the benefit of their researcher constituents, and advising them how to select the best range of products and services to meet their needs.

## **6.0 Conclusion**

The amount and type of information, and the techniques available to researchers, is growing. In today's competitive research world, digital libraries have an important and growing role to play in supporting researcher success by helping them to navigate today's complex information world.

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