

Open Access: Major Issues and Global Initiatives

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ABSTRACT

Free availability of scientific data, information and knowledge has played a key role in the phenomenal developments in science. At present, high and ever increasing cost of scientific literature is a major barrier to access to knowledge, particularly in the developing world. A number of initiatives like the Budapest Open Access Initiative, ECHO Charter, Bethesda Statement on Open Access Publishing and Berlin Declaration have emphasized on open access. Studies by the Wellcome Trust have concluded that it should be viable to move towards another system and that system should be more efficient and less expensive. Dissemination of scientific results through Internet and associated digital technologies is cost effective, efficient and beneficial to producers and users of knowledge. CODATA has been actively engaged in propagating open access. Some of its recommendations found place in the Declaration of Principles and Agenda for Action of the World Summit on Information Society (WSIS). In the second and final phase of the Summit at Tunis (November 2005) CODATA presented the viewpoint of scientific stakeholders and a new proposal on Global Information Commons for Science (GICSI). CODATA recommendations were evolved after in-depth deliberations involving scientists and technologists, legal experts and noted economists and with the active participation of organizations like ICSU, UNESCO, ICSTI, INASP, IAP, TWAS and US NAS and collaboration of OECD. Recently, CODATA at the request of GEOSS successfully led the task concerning with practical applications of agreed GEOSS Data Sharing Principles (GEOSS Task DA-06-01).

Keywords: Open access, scientific knowledge, Berlin declaration, ECHO charter,

1. INTRODUCTION

The phenomenal advancements in all scientific fields in the recent past have transformed the human society. One of the key enabling factors in these amazing achievements has been the free availability of scientific data and information. In the pre-digital revolution era, the exchange of scientific and technological data, information

and knowledge had been exclusively through published literature. The private enterprises with the collaboration of scientific and technical community have played an important role in efficient distribution of latest developments among scientists at global level. However, the costs of the publications have been rising at a very high rate, making access to scientific results restrictive. The developing world is the worst sufferer. At present, even the developed

economies are finding it hard to cope with this situation. As a reaction, in many countries due to public pressure scientific results generated through projects funded by public money are coming in open domain. On the other hand the fast rate of developments in the Internet and communication technologies have opened up new efficient and low cost options. The use of world wide web and the associated digital technologies offer opportunities, which have potential to provide low cost efficient options. Already, a huge volume of scientific information is available freely on the web. However, the information and knowledge that has not gone through the proper peer review process is quite injurious to the growth of science and in spreading awareness about science among common people.

Several studies have been carried out to understand the basic issues and possible solutions. Also, several initiatives have been taken at global level to find widely acceptable solutions. There has been a UN Summit on Information Society (2003 and 2005) in which CODATA had presented the views of the scientific community. A new concept evolved by CODATA and several important organizations like UNESCO, ICSU, IAP, TWAS, ICSTI, INASP in the form of Global Information Commons Science Initiative (GICSI) was presented at

the Summit Plenary Session in November 2005. This paper reviews these developments.

2. HIGH COST OF PUBLISHED SCIENTIFIC LITERATURE AND BARRIERS TO ACCESS SCIENTIFIC KNOWLEDGE

At present most of the research and development work is carried out in universities, national laboratories or in research establishments of industries or other private organizations. The research papers are prepared by scientists and submitted for publication in appropriate journals. These are subjected to peer review, an exercise carried out by scientists who are experts in that field. These are finally published in the journals. Figure 1 shows the publication cycle. The journals are accessible to researchers and others through libraries, which pay ever-increasing subscriptions to acquire the same. Two groups are involved in the whole process. These are:

- (i) Group I comprising of Funding Agencies; R&D laboratories; active scientists, who conduct research, produce scientific literature, are involved in the refereeing process and proof reading; and Libraries; and

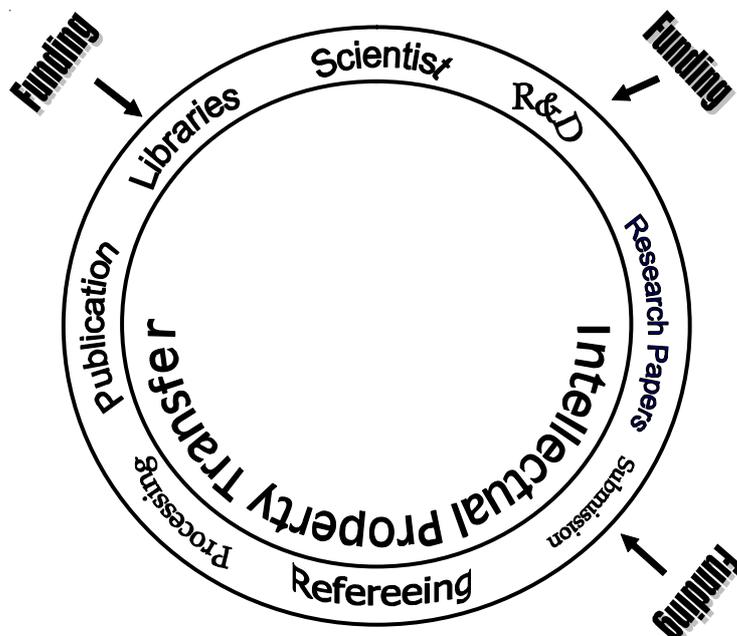


Figure 1. A schematic diagram depicting the publication of scientific research papers in journals.

- (ii) Group II comprising of Publishers and Marketing agencies.

It is obvious that there is a one-way transfer of funds from Group I to Group II. The laboratories fund the R&D and scientists create scientific literature by following steps mentioned above and finally their laboratories pay for the final product, in whose production they had played a vital role. The publishers have a legitimate right to recover their costs and make reasonable profit. However, the prohibitive costs of books and journals are raising questions about the level of profits and the technologies of production. Also, the possibilities of new digital technologies for dissemination of scientific literature are being tried globally. Among others the Data Science Journal of CODATA is one such example. The Proceedings of Indian National Science Academy is available on the web and is also available as a hard copy.

In view of the high cost of publication of the scientific literature, in particular, scientific journals, several studies have been conducted to understand as to how the expenses can be controlled. The Wellcome Trust, UK (www.wellcome.ac.uk/publications) has played an important role in this respect. This Trust is a leading bio-medical charity, which spends more than £ 400 million each year for scientific research. The Trust has stressed that as sponsors of R&D they have the right to understand and influence as to how their funds are utilized and in which way, the results of research are disseminated. An Economic and Management Consultancy Company, SQW was engaged to investigate the scientific publishing sector. The report of SQW has provided an in-depth knowledge about the economics of scientific publishing industry and the way in which scientific knowledge is disseminated. This study has shown that the projections of the production cost of printed literature are exaggerated. They have also concluded that sponsors of R&D in non-commercial and non-strategic sectors should ensure that the results of important projects are widely distributed. Therefore, it is necessary to look at alternative methods of dissemination of R&D results with due credit to all the key stakeholders.

The second report of Wellcome Trust is named as Costs and Business Models in Scientific Research (April 2004). In this study it has been concluded that Open Access should be able to deliver high quality peer reviewed research publications at a cost that is substantially lower than that in the traditional model. It will also be beneficial in other aspects. These reports stressed that Open Access would allow far wider dissemination and much higher impact of the research work. Also, it will reduce the barriers to access of scientific information for researchers all over the world. Such an approach will have significant positive impact on the R&D organizations in the developing world. Several international scientific bodies have also recognized the importance of Internet as an emerging powerful media for dissemination of knowledge. It has led to the Budapest Open Access initiative, ECHO Charter, Bethesda Statement on Open Access Publishing and Berlin Declaration.

3. BERLIN DECLARATION

The Berlin Declaration spearheaded by the Max Planck Society and signed by over 200 leading organizations including Indian National Science Academy, New Delhi have given a road map for Open Access materials (<http://www.zim.mpg.de/openaccess-berlin/signatories.html>). Open Access has been defined as a comprehensive source of knowledge and cultural heritage that has been approved by the scientific community. It covers:

- (i) Original scientific research results;
- (ii) Raw data and metadata;
- (iii) Source materials;
- (iv) Digital representation of pictorial and graphical materials; and
- (v) Scholarly multimedia materials.

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The Declaration wishes to find solution that will also improve the existing legal and financial frameworks to be relevant in the new paradigm.

4. ROLE OF CODATA IN SUPPORTING AND PROPAGATING OPEN ACCESS

CODATA, the Committee on Data for Science and Technology of the International Council of Science (ICSU) was born at Bombay in 1966 and has its headquarters at 5 rue Auguste Vacquerie, 75016 Paris with its own website—www.codata.org. CODATA promotes and encourages on a worldwide basis the compilation, evaluation and dissemination of reliable numerical data of importance in all fields of science and technology. It may be emphasized that CODATA is concerned with all types of data resulting from experimental measurements, observations and calculations in every field of science and technology including physical sciences, biology, geology, astronomy, engineering, environmental science, ecology and others. In fact, the fundamental constants of science are released every few years under recommendations of CODATA and are available freely through Internet.

CODATA organizes biennial International Conferences, where topics of relevance to data science and dissemination of data are discussed. The last Conference was held in Beijing in October 2006 and the next Conference will be organized at Kyiv, Ukraine in October 2008. In addition, specialist

meetings of experts are also organized from time to time. CODATA brings out a free peer reviewed electronic Data Science Journal, which can be accessed at <http://dsj.codataweb.org>. For specific activities, CODATA sponsors Task Groups in different fields including one on Fundamental Constants. Specialist groups are also working to tackle the difficult problem of digital divide. Some details are available at the CODATA website.

5. WORLD SUMMIT FOR INFORMATION SOCIETY

United Nations had organized a World Summit for Information Society (WSIS) in two phases. The first phase was organized in December 2003 at Geneva and the second and final phase was organized in November 2005 at Tunis. The Summit stressed the importance of access to information and knowledge for global welfare. CODATA presented the input of scientific stakeholders for WSIS at Geneva as well as at Tunis. In this effort, CODATA collaborated with ICSU, ICSTI, INASP, UNESCO, IAP and TWAS. For some of the activities, OECD also collaborated. CODATA had organized a Workshop at UNESCO prior to the Geneva phase. 175 countries adopted a landmark Declaration of Principles and Agenda for Action. Paragraph 7 of the Declaration of Principles states that "Science has a central role in the development of the Information Society". Article 10 of the Agenda for Action recognizes the importance of "Access to Information and Knowledge", and Article 23 recognizes the important role of "e-Science".

An International Workshop with ~100 experts from 25 countries having diverse backgrounds ranging from legal expertise to hard core scientific fields and economics deliberated upon ways and means of bringing more and more scientific knowledge and information in the open domain. A new initiative on Global Information Commons for Science (GICSI) was evolved after detailed deliberations at this meeting. The viewpoint of the scientific stakeholders was presented by Professor Shuichi Iwata, President, CODATA at the Plenary Session of the WSIS at Tunis in 2005. Just prior to the Summit, an editorial

was published in the prestigious journal *Science* by Shuichi Iwata and Robert Chen (Iwata, S. & Chen, R.S. *Science and the Digital Divide* (editorial). *Science*, 2005, **310**(5747), 405). Professor Iwata stressed that GICSI is a multi-stakeholder undertaking with the following goals:

1. Improved understanding and increased awareness of the societal benefits of easier access to and use of scientific data and information, particularly those resulting from publicly funded research activities;
2. Wider adoption of successful methods and models for providing open availability on a sustainable basis and facilitating reuse of publicly-funded scientific data and information, as well as cooperative sharing of research materials and tools among researchers; and
3. Encouragement and coordination of the efforts of the many stakeholders in the world's diverse scientific community who are engaged in efforts to devise and

implement effective means to achieve these objectives, with particular attention to data and knowledge transfer from haves to not-haves, e.g., next generations, non-experts, developing countries.

6. CODATA AND GEOSS TASK ON FURTHERING THE PRACTICAL APPLICATION OF DATA SHARING PRINCIPLES

Global Earth Observation System of Systems (GEOSS) had adopted a 10 years implementation plan in early 2005. CODATA was requested to lead the task concerning with practical applications of agreed GEOSS Data Sharing Principles (GEOSS Task DA-06-01). CODATA constituted a Committee chaired by Dr Paul Uhlir of US National Science Academy. The Committee had prepared a White Paper, which was widely circulated among experts in this field and was finally presented at the GEOSS Ministerial meeting held in Cape Town, South Africa at the end of November 2007. This effort has been well appreciated.

About the Author



Dr Krishan Lal, former Director, National Physical Laboratory (NPL), New Delhi is presently an emeritus scientist at NPL. He is currently President CODATA a multi-disciplinary Committee on Data for Science and Technology established by International Council of Science (ICSU). His research area of specialisation is Solid State Physics; Materials Characterisation; Crystal Growth and Lattice Imperfections, High Resolution X-ray Diffraction, Instrumentation; Quality Management, Certified Reference Materials and Data for Materials. Dr Krishan Lal is Honorary Professor, Indian Institute of Technology (IIT), Kanpur. He was IBM India Fellow at Watson Research Centre, New York; Visiting Professor, University of Tokyo, Tokyo; Technical University Darmstadt, Darmstadt; and Sr. Visiting Scientist at Physikalisch-Technische Bundesanstalt, Braunschweig. He was also Visiting Professor IIT Delhi and Jamia Millia Islamia and Adjunct Professor, IIT Kharagpur. Dr Lal has received several honours and awards that include Honorary Doctorate, Russian Academy of Sciences; Editor, *Zeitschrift für Kristallographie*; Member, Asia-Pacific Network on Materials Evaluation Technology, Korea; Member, Asia-Pacific Academy of Materials; and President, Indian Crystallography Association. He is Fellow of Indian National Science Academy (INSA), New Delhi and National Academy of Sciences' India, Allahabad. Dr Krishan Lal has been Chairman of six International Symposia/Workshops/Schools. He has delivered more than 100 invited talks in reputed national/international conferences. He has edited 8 Books/Volumes, published 22 Invited Papers in journals/Chapters in Books, more than 100 research papers in refereed journals and has seven patents to his credit.