Perspectives on Managing Knowledge in the Data-Centric Research Landscape

Usha Mujoo-Munshi

Abstract

The current scenario of migrating from data deficit to data deluge situation is forcing us to give a thought to bring meaning to the mess by effectively managing the data tsunami. In the Knowledge society, the competitive advantage is gained through understanding the information and predicting the evolution of facts based on data. Digital transactions whether social, economic or in relation to government create data which can, in principle, be used for research and innovation. The present paper touches upon various perspectives of knowledge management in the data centric research landscape. While reflecting on the behavioural aspects of the authors, the paper delineates how the researcher's environment of working with their own silos with their own small data sets is marking a paradigm shift in approach to collaborate as a community for sharing, accessing data for re-purposing to generate new knowledge. The data generation out of the research activities particularly scientific discoveries is colossal and very significant for brining innovations in research. For this, the author remarks that the key issues are to decipher mechanisms for construing, analysing and extracting meaningful information from this colossal data and manage this ever growing universe of knowledge to provide a robust resource support system for research and innovation, and thereby avoiding duplication of efforts. The paper while highlighting the core challenges, elicits issues that can help in managing data searching, discoverability and usability. To this effect, a number of initiatives that are going on world over to promote effective data documentation and sharing to enable reuse have been educed. Emphasis has been laid on making space for innovation, rather than enforcing rules for innovation by following the new norms for creating discipline in three domains- learning, capturing and reflecting on the technology frontier. The paper illustrates several perspectives w.r.t. Library's role in Big Data and generating knowledge assets for which capacity enhancement becomes naturally imperative. To this effect, attention has been drawn to various aspects on what Librarians need to know about Big Data and play a part in the ecosystem.

Keywords: Knowledge Management, Big Data, Academic Libraries

1. Introduction

The smart future knowledge trends are irrevocably (irretrievably) going to make evidence based event generation in all walks of life. This primarily is attributed to the availability of data/information due to relentless parading technologies that are cropping up on all fronts. Not that all technologies change the status quo, but some do. The data tsunami is the direct result of the IoT (Internet of Things). The data is pervasive in all fields and is a strong pillar for sustainable development. One cannot perceive public policy formulation based on the intuition, but

smart decisions would necessarily need evidences for smart policy formulation. There is enormous amounts of Data available to research, science & society. The experts called it Fourth Paradigm (1st being period of observation, description & experimentation, 2nd development of theory explaining the way world works, 3rd developed earlier theories to create extensive simulations & models and 4th is Big Data presenting many new opportunities for analysis as well as requiring new modes of thinking). So we have moved from data deficit to data deluge.

The current scenario of migrating from data deficit to data deluge situation is forcing us to give a thought to bring meaning to the mess by effectively managing the data tsunami. The Big Data is characterized by velocity (Data comes at high Speed), volume (Data results into large files), variety (Files come in various formats) and finally with the value that could be extracted from them(often added as a fourth V).

The growth in volume & variety of data and its subsequent analytics for drawing inferences are going to be humongous. Personal and other ubiquitous electronic devices add to this wealth of data, on top of the data being generated from social media (around 80%).

The computing size of general-purpose computers increases annually at a rate of 58% . With respect to data analytics, standard tools and techniques have not been designed to search and analyze large datasets. The Big Data sources are varied and the types could be both structure and bulk of it being non-structured. According to Computer World, unstructured information may account for more than 70% to 80% of all data in organizations. The real challenge lies in processing unstructured data sources in Big Data projects, particularly with regard to the scalability, low latency, and performance of data infrastructures and their data centers that needs to be addressed.

In 2012, 2.5 quintillion bytes of data were generated daily, and 90% of current data worldwide originated in the past two years (and Big Data, 2013). By 2020, enterprise data is expected to total 40 ZB, as per IDC. According to Industrial Development Corporation (IDC) and EMC Corporation, the amount of data generated in 2020 will be 44 times greater [40 ZettaBytes (ZB)] than in 2009. This rate of increase is expected to persist at 50% to 60% annually. Taking typical examples of Big Data generation, the Large Hadron Collider (LHC) at CERN (European Organization for Nuclear Research) has created 22 PetaBytes of data in 2012 (1 PetaByte = 10^{15} bytes); secondly the largest producer of the data would be Square Kilometre Array (SKA) (www.skatelescope.org)when completed is expected to produce ~one Exabyte of raw data/per day (1 Exabyte =10^{18} bytes) & with ~3000 receiving dishes will produce a combined information collecting area of one square kilometer. "The data rates involved in this will exceed that of the entire global Internet traffic per day". Thus the crux of the "Big Data paradigm' is actually not the increasingly large amount of data itself, but its analysis for intelligent decision-making.

In the Knowledge society, the competitive advantage is gained through understanding the information and predicting the evolution of facts based on data. The real problem is that Governments are swimming in more data than they have ever had but they lack the capacity in their staff to do

anything with it. Thus far, the essential landscapes of Big Data have not been unified.

As Emmanuel Lelouze said "A true Big Data revolution should be one where data can be leveraged to change power structures and decision making processes, not just create insights" Big Data certainly sees huge potential to mine the hidden treasures in the world's digital era to improve decision making, though the idea fraught with technical difficulties due to not so mature ecosystem and evolving infrastructure. Thus Big data's great promise for development will surely need both human and technical capacity building.

2.1 Data for Research and Innovation

In many parts of the globe, the way in which people operate is increasingly digitally mediated. Digital transactions whether social, economic or in relation to government create data which can, in principle, be used for research and innovation. For social scientists there are enormous opportunities and challenges. Not only does such Big Data offer a means of understanding society, these interactions are a phenomenon to be studied in its own right as they are now shaping society. Until now we have been working as researchers in our own silos with our own small data sets. "If we really want to move this forward there has to be infrastructure that we can access in real time so that we can all collaborate as a community." The data generation out of the research activities particularly scientific discoveries is colossal and to this effect we have noticed the kind of data generation by LHC and expected volume from SKA projects.

The key issue thus is how do we analyse and extract meaningful information from this colossal data and manage this ever growing universe of knowledge to provide a robust resource support system for research and innovation, avoiding duplication of efforts.

2.2 Managing Data Search, Discoverability and Usability

Managing data in this data-centric science and research epoch is highly desirable to ponder over the issues and challenges prevalent in discoverability, access, use/re-use and re-purposing of the data for generation of new knowledge. There are a multitude of challenges and opportunities around the issue of Big Data. The core challenges are in the areas of data Capture, Curation, Storage, Search, Sharing, and Transfer. The four themes that emerge from various forums focus on –

- ❖ Data Needs
- ❖ Building Capacity
- ❖ Building Community
- ❖ Fostering Innovation

There are a number of initiatives going on world over to promote effective data documentation and sharing to enable reuse. For instance FAIR a set of guiding principles to make data Findable, Accessible, Interoperable, and Re-usable) principles, OECD principles,[15] the Royal Society concept of 'intelligent openness'[16] and the RDA Global Digital Object Cloud[17] (an abstract global data architecture that is based on resolvable global persistent identifiers and globally accessible metadata and that has the potential to revolutionize the currently fragmented data landscape) and other similar principles. So deciphering the characteristics that allow data to be findable, accessible, interoperable and reusable through systemic ordering,

transforming and analyzing primary data across domains (life sciences, physical sciences, social sciences, digital humanities) for gaining knowledge to make decisions is the core job at hand for knowledge organization. Good data management is key pathway to prosperity for knowledge discovery and innovation and its subsequent integration and re-use for re-purposing. How will these guiding principles (such as FAIR) help in knowledge organization using standardized technical discovery tools such as -Data Citation with global persistent IDs, Rich Metadata, Access and usage controls (data can be restricted, but citation and metadata always publicly accessible), APIs and standards (SWORD, OAI-PMH, Dublin Core and DDI metadata standards, PROV (ontology standard to capture provenance of a dataset) and the like.

It is widely acclaimed that the concept of the "Digital Object (DO)" is central to proper data management, access and use. A DO has a bit sequence that can be stored in multiple repositories and is associated with a Persistent Identifier (PID) and quality metadata.As Lisa Gitelman states that "we shouldn't think of data as a natural resource but as a cultural one that needs to be generated, protected, and interpreted." (this is a quoted text and placed within the "" with appropriate citation.)

3.0 Knowledge Management and the New Norms

In managing the current research ecosystem, the information providers and knowledge managers need to follow the new norms by creating discipline in three domains- learning, capturing and reflecting. This calls for making space for innovation, (rather than) enforcing rules for innovation. In this transition we need to move from managing our stocks of knowledge to participating in flows to leverage flows for learning & accelerating capability building. These advances ought to take place along the Technology Frontier for creating, finding, refining, sharing and utilising knowledge assets, which in FAIR principles is reflected as Findable, Accessible, Interoperable, and Re-usable (FAIR)

In the data-centric knowledge society, research data culture ecosystem needs to take on board all the critical players in the research community and the key requirements, such as addressing research culture, workflows and skills requirements and the like to make data discoverability a reality using machine-actionable approaches. The further improvements to current Data Management Plans (DMPs) to make them robust in character in terms of becoming more integrated and machine-actionable, so that eventually data discoverability also improves innovatively.

4.1 Library's Role in Big Data and Generating Knowledge Assets

The question/s here is - how could the oldest institution of the world "The Library" play a pivotal role in the knowledge management in the (big) data-centric universe of knowledge? More appropriately, what is the role of library in the 'Big Data' world? The Big Data landscape is a multi-stakeholder domain and there is a big opportunity for Librarians to play a role in the Big Data universe for facilitating data-driven decision making possible. The vision for Library should be - nurturing a collaborative eco-system to evolve robust structure for science /research communication; ubiquitous, reliable and seamless access to scholarly resources; data mining & visualization and capacitating information professionals & science/research communicators for strategic leadership roles by facilitating robust

resource back-up. Many empirical studies have enumerated the pivotal role that the Library can play in the emerging data landscape. [20]

To continue demonstrate our value, we need to embrace all opportunities through deep collaboration, trust, and proving value. Libraries and librarians are uniquely suited to working with Big Data. Libraries have a long tradition of being early technology adopters, and Big Data should be no exception.

Big data is a natural fit for the Library. In the data management landscape the Library could right away play critical role in a tri-pronged approach. (i) What are the sources to derive data for faster, better decision making process ; (ii) Based on the data derived from the usability, the effective products and services could be developed?; and (iii) How to measure the efficacy of the library and increasing its valuation in the institution?

Taking the cognizance of the above approaches and with reference to the kind of sources that need to be tapped comprise the smart library data (campus data, library data, client data, data generated out of new sensors on the fly, etc) that could be a combination of structured, semi-structured and un-structured data. In fact everything that can create an eco-system for learning process.

Trend of data-fueled research is ubiquitous in all sectors, creating the opportunity for librarians to collaborate with other disciplines to fill a service gap. Thus having identified the sources and based on the data derived from the usability, the effective products and services could be developed. The core roles demands the required input, action and output from the library domain is to select valuable resources, organize those materials, describe those materials, preserve those materials , provide access to those materials in a trusted environment, and help others find them.

Since 2011, a number of variants of job titles cropped up to cater to the specific services generated out of the emerged data domain . The examples of these variants (depending on the nature of the organization) include Data Management Consultant, Data Mining Consultant, Data Research Scientist, Data Services Librarian, Design Data Librarian, Digital Archivist, Strategist and Architecture Librarian, Digital Humanities Design Consultant, Manager – Data Research Data Librarian, Scientific Data Curation Specialist / Metadata Librarian, Scientific Data Curator, Social Science Data Consultant, Data Scientist and the like. The data is the rawest form of information; the data scientist is the closest relative to the information scientist. All these requires understanding of what data we have, what data we need to have created, what data we need to negotiate for, and then gaining access and doing the analysis. Then, it requires us presenting the results of our analysis to our management and users, so as to make decisions. It helps the professionals to steer the organizations further[21]. Some academic libraries have elected to take a more active role in data management. Typical example could be the case study of Purdue University's development of data the repository, Purdue University Research Repository (PURR), that demonstrates the libraries involvement in creating a solution to the data needs of its researchers. The library joined forces with information technology and research departments to create PURR. The library, being the forefront of data instruction and reference, while also being knowledgeable on

metadata standards, was a critical leader in the development process. The data repository is an exemplary way for libraries to provide data service to its patrons while also exhibiting control over data produced by the organization. There are number of research data centers, predominantly domain specific though some are also generic in nature. The typical examples include: Antarctic Environmental Data Centre, Archaeology Data Service, Biomedical Informatics Research Network Data Repository, British Atmospheric Data Centre, British Library Sound Archive, British Oceanographic Data Centre, Cambridge Crystallographic Data Centre, Economic and Social Data Service, Environmental Information Data Centre, European Bioinformatics Institute, Geospatial Repository for Academic Deposit and Extraction, History Data Service, Infrared Space Observatory, National Biodiversity Network, National Geoscience Data Centre, NERC Earth Observation Data Centre, NERC Environmental Bioinformatics Centre, Petrological Database of the Ocean Floor, Publishing Network for Geoscientific and Environmental Data (PANGAEA), Scran, The Oxford Text Archive, UK Data Archive, UK Solar System Data Centre, Visual Arts Data Service, and the like. To meet funder requirements for data management plans, it has also become important to show how the data will be treated during and after the research project, and it is in this domain also that librarians and libraries need to be key stakeholders.

4.2 What Librarians Need to Know About Big Data

The pervasive role of Big Data in all walks of life, necessitates the Library professionals to take cognizance of its potential impact in the research landscape. As such it becomes imperative that the librarians and information providers in various domain specific (such as science, business, special, social science libraries and information centres) institutions/organizations get groomed in the very fundamentals of the Big Data, so that they can facilitate the researchers in generating value from the data-centric research landscape by using the data for generating new knowledge. The services that have cropped up due to changing environment, necessitates capacitating existing and future breed of library and information personnel in the requisite skills, necessary to operate in the Big Data environment to suffice the user's needs. Mining data, even identification of requisite datasets, preparation of Data Management Plans (DMPs), etc. are some of the areas that are on the cards for the professionals. Because librarians are deemed to be one of the important stakeholders in the Big Data world, a number of international organizations have chipped in to organize capacity enhancement programmes for the professionals. For instance , a number of agencies of late, are facilitating training and several empirical studies, tools and resources point towards the desired role of professionals and need for timely filling the requisite requirements of their user-base. Besides, library and information professionals themselves are grappling with the issue of changing data-centric research landscape and mechanisms of addressing the research data demands. Good research demands good data and precisely a number of designations have come to the forefront to meet the pressing demand. For instance, some jobs posted since 2011 include titles like - Data Management Consultant, Data Mining Consultant, Data Research Scientist, Data Services Librarian, Design Data Librarian, Digital Archivist, Digital Collections, Strategist and Architecture Librarian, Digital Records Archivist, Research Data

Librarian, Scientific Data Curation Specialist / Metadata Librarian, Social Science Data Consultant, Data Scientist and the like. Thus the specialized roles would invariably demand that librarians and information professionals need to be aware of how Big Data can be used to support researchers in their research process.

4.2.1 Big Data Curation

In the Big Data world, it becomes predominantly imperative that the library professionals have understanding of the data curation, so that they can facilitate a robust data service support system. Unless they are themselves in the know how of the nitty gritty of the data curation processes, it may not be at all effective to eventually capacitate the researchers in the show how. Being able to make datasets more useful, searchable and accessible and eventually helping to smooth the progress of organizing, accessing, sharing, storing and preserving the datasets by the researchers, has of late become an important chore of the so called data scientists in the libraries and information centres. Just the way librarians know the value of traditional information sources, now they also need to know the worth of raw data and its mounting and mining by both the librarians themselves and also by researchers for re-purposing. Thus data curation has become an activity in perpetuity for libraries.

4.2.2 Next Steps for Academic Libraries

The availability of the more advanced tools and techniques for the analytics purposes necessitates that library administration and management to look closely into venturing in the Big Data domain for providing data centric services to the researchers. What kind of datasets they need to gather and analyse would primarily depend on the nature and goal of the institution. Attempting to make endeavours to do something new which hitherto was not possible due to lack of key mechanisms and means. For instance, grabbing the opportunity to indulge in analyzing massive datasets which previously were out of reach due to software or hardware constraints. Alongside the research output in the institutional repositories, the professionals need to store and mount the raw research data of their researchers and faculty for use and re-use by others.

Though the challenges in handling Big Data in the library set-up are many, but availing the opportunity to understand the issues and possibilities that Big data offers to researchers, administration and the librarians are worth the effort , to create knowledge assets that have potential to deliver in the immediate near future

4.2.3 How librarians can get involved with Big Data

There are several fronts where librarians and libraries can make crucial contribution.

- ❖ The first and foremost is the Better decisions about collection
- ❖ development collection development and preservation of data sets.
- ❖ The other areas are :
  - ■ Updating public spaces
  - ■ Usage Data to provide Use Statistics (Tracking use of library materials through your LMS)
  - ■ Be leader on Big Data curation

- Research Data Management (Providing guidance to storing and making accessible Big Data sets)
- Rescuing the data (that has dithering print equivalents and no digital equivalents)
- Data Literacy into their instructional programs
- Foster the ethical practices of data citation in the research landscape of your institution
- Creating Knowledge Models using visualizations

Now is the opportunity for your library to understand the issues and opportunities Big Data offers to researchers, administration, and the librarians at your institution.

But all these requires understanding of what data we have, what data we need to have created, what data we need to negotiate for, and then gaining access and doing the analysis. And subsequently presenting the results of our analysis to our management and users, for making evidence based smart decisions.

It may be pertinent here to talk about creating knowledge models using visualizations. In order to create meaning out of mess, representing large un-structured datasets into meaningful visualizations to facilitate policy makers to take smart decisions are highly desirable in the data-centric world. For instance in one of the projects by IIPA on Ganga Knowledge portal (part of Clean Ganga Mission) , we created knowledge models by modeling the huge un/semi-structured data to reveal the behavior of industries along the terrain of Ganges in all states through which the river Ganga flow. The parameters for which the visualizations of the knowledge models were created included data from 1000s of different industries , their types, water consumption, waste water generation, showcasing the discharge in the river itself or its tributaries and their correlation. The activity resulted in generating knowledge models that effectively portrayed the nitty-gritty of the prevailing scenario for smart decisions.

Having said that, one important aspect that crops up and is currently of core concern is huge shortage of talent pool. There are some initiatives in this direction, where short-term capacity enhancement programmes are being organized by many leading agencies[28], [29]where most of the energy about data is concentrated. Also of the core importance is the research data policy, which is grossly missing from the national scene presently. There have been noteworthy efforts at the international level[30] and in May 2014 a report[31] was submitted that provided a framework for the development of data policies based on the survey results of current best practice and by identifying key elements. The international data policy has now initiated endeavouring to look at further granularity to provide a common framework on data policy.

5.1 Conclusion

We live in an era of Big Data, the data generated in academic institutions is vast and complex. The idea of extracting new and exciting insights from previously unmanageable data is a bit like finding the proverbial 'needle in a haystack'. Just as they have with previous technological advances, librarians should become familiar with the possibilities and problems inherent to Big Data and use that knowledge to help their patrons choose

the right tools. The academic librarians have a clear role in data analytics to help the institutions and the stakeholders in bettering the services and quality of education. And lastly, what is of great importance is to put thoughts together for evolving a feasible research data policy that would give impetus to various activities w.r.t research data landscape, same way as the other research resource-bases got nurtured in the electronic era. Lastly, an inventory of what has taken place in the data field is highly recommended.

References

1 Tony Hey, Stewart Tansley, and Kristin Tolle (Eds).The Fourth Paradigm: Data-Intensive Scientific Discovery, Microsoft Research Redmond, Washington, 2009. Available at: http://www.immagic.com/eLibrary/ARCHIVES/EBOOKS/M091000H.pdf

2 K. Douglas, "Infographic: Big Data brings marketing big numbers," 2012, http://www.marketingtechblog.com/ibm-big-data-marketing/ (SAME AS 6)

3 M. Hilbert and P. López, "The world's technological capacity to store, communicate, and compute information," Science, vol. 332, no. 6025, pp. 60–65, 2011. • Availaable at : http://science.sciencemag.org/content/332/6025/60

4 J. Manyika, C. Michael, B. Brown et al., "Big data: The next frontier for innovation, competition, and productivity," Tech. Rep., Mc Kinsey, May 2011. Available at : http://www.citeulike.org/group/18242/article/9341321

5 A. Holzinger, C. Stocker, B. Ofner, G. Prohaska, A. Brabenetz, and R. Hofmann-Wellenhof, "Combining HCI, natural language processing, and knowledge discovery—potential of IBM content analytics as an assistive technology in the biomedical field," in Human-Computer Interaction and Knowledge Discovery in Complex, Unstructured, Big Data, vol. 7947 of Lecture Notes in Computer Science, pp. 13–24, Springer, Berlin, Germany, 2013. Available at : https://link.springer.com/chapter/10.1007/978-3-642-39146-0_2

6 K. Douglas, "Infographic: Big Data brings marketing big numbers," 2012, http://www.marketingtechblog.com/ibm-big-data-marketing/

7 Jeff Bullas, "Social Media Facts and Statistics You Should Know in 2014," 2014, http://www.jeffbullas.com/2014/01/17/20-social-media-facts-and-statistics-you-should-know-in-2014/.

8 S. Sagiroglu and D. Sinanc, "Big data: a review," in Proceedings of the International Conference on Collaboration Technologies and Systems (CTS '13), pp. 42–47, IEEE, San Diego, Calif, USA, May 2013. Available at : https://scholar.google.com/scholar?q=https://doi.org/10.1109%2FCTS.2013.6567202

9 IDC, "Analyze the future," 2014, http://www.idc.com/.

10 The Large Hadron Collider https://home.cern/topics/large-hadron-collider

11 http://skatelescope.org/sdp/

12 Emmanuel Letouzé. Big Data and Development: An Overview . Data-Pop Alliance Primers Series , November 17th, 2014 Available at: https://static1.squarespace.com/static/

531a2b4be4b009ca7e474c05/t/5469810fe4b027698c28ade7/1416200463573/PrimerOverviewBigDataDevNov17Draft.pdf

13 Wilkinson, M. D., M. Dumontier, I. J. Aalbersberg, G. Appleton, M. Axton, A. Baak, N. Blomberg, et al. 2016. "The FAIR Guiding Principles for scientific data management and stewardship." Scientific Data 3 (1): 160018. doi:10.1038/sdata.2016.18. http://dx.doi.org/10.1038/sdata.2016.18.

14 FAIR Principles: https://www.force11.org/group/fairgroup/fairprinciples

15 OECD. OECD Principles and Guidelines for Access to Research Data from Public Funding. Available at: https://www.oecd.org/sti/sci-tech/38500813.pdf

16 The Royal Society. Science as an Open Enterprise. London, Royal Society, June 2012.. Available at: https://royalsociety.org/~/media/policy/projects/sape/2012-06-20-saoe.pdf

17 Larry Lannom, Peter Wittenburg . Global Digital Object Cloud. 2016 https://b2share.eudat.eu/records/523d1eac4068431b905d1b5ff8466d95 . Also Available at: https://www.rd-alliance.org/group/data-fabric-ig/wiki/global-digital-object-cloud

18 DFT Model: http://hdl.handle.net/11304/5d760a3e-991d-11e5-9bb4-2b0aad496318

19 Gitelman, Lisa (Ed.) Raw Data Is an Oxymoron. The MIT Press, 192 pp. January 2013 ISBN: 9780262518284

20 Furlough, Mike. Press release and announcements. Available at: https://www.hathitrust.org/mike_furlough_executive_director

21 Boris Capitanu; Ted Underwood; Peter Organisciak; Timothy Cole; M. Janina Sarol; J. Stephen Downie (2016): The HathiTrust Research Center Extracted Features Dataset. 1.0 [Dataset]. HathiTrust Research Center. Dataset. http://dx.doi.org/10.13012/J8X63JT3. Big (and Open) Data for Scholarship of All Sizes: A New Release of the HathiTrust Research Center Extracted Features Dataset

22 Pudue University.. Purdue University Research Repository. https://purr.purdue.edu/

23 Samuel, Sara M., Grochowski, Paul F., Lalwani,Leena N. Analyzing Data Management Plans: Where Librarians Can Make a Difference. Paper ID #12072. Avaialable at : www.asee.org/public/conferences/56/papers/12072/download

24 DataONE. DataONE for Librarians. Carly Strasser, Stephanie Wright, Gail Steinhart DataONE Community Engagement and Education Working Group. https://www.dataone.org/sites/all/documents/DataONEforLibrarians.pdf

25 DCC. RDM for Librarians. http://www.dcc.ac.uk/training/rdm-librarians

26http://www.dcc.ac.uk/training/data-management-courses-and-training

27 Data Scientist Training for Librarians. www.dst4l.info

28 CODATA, The Committee on Data for Science and Technology www.codata.org/

29 Research Data Alliance (RDA). https://www.rd-alliance.org/

30 International Data Policy Committee. http://www.codata.org/strategic-initiatives/international-data-policy- committee

31 The Report on Current Best Practice for Research Data Management Policies. Available at: http://dx.doi.org/10.5281/zenodo.27872

About Author

Mrs. Usha Mujoo-Munshi, Librarian, Indian Institute of Public Administration, New Delhi
Email:umunshi.iipa@gov.in