7-5-2022

Bridging the Technical Issues for Successful Research: Role of Librarians in Bangladesh

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Abstract

Very simply, research is the systematic investigation to explore new knowledge for scientific achievement. Research comprises "creative and systematic work undertaken to increase the stock of knowledge, including knowledge of humans, culture and society, and the use of this stock of knowledge to devise new applications" (OECD, 2015). Research carried out by scientists and researchers has made an enormous impact on the world over the centuries specially for developing countries like Bangladesh. Research can make a significant contribution to the growth and development of any nation. Research and the library are closely interconnected with one another. Libraries especially academic and special libraries responsible for research support that is treated as central pillar in their mission. A "researcher life cycle" approach was applied to identify researcher information needs. Librarians continue to play a central role in conducting successful research and are expanding beyond their traditional duties for delivering high quality information services to engage themselves more as educators, technological guides, and communicators. Librarians should pace more and more into a leadership role develop major initiatives and conduct training to increase research reproducibility. The present paper focuses on the basic technical issues of efficient research skills and highlights the librarians' competencies for research support of Bangladesh for guiding researchers for conducting successful research and ensuring a better work environment to do research. This paper mainly explores the proper referencing and citations, submission of manuscript in impact journals, find out predatory journals and selection for publishing articles in open access journals. This study also highlights the use and impact of various online databases such as Web of Science (WoS) and Scopus in order to explore citation status, *h* index and research performance of an individual author, country and institution. The study also investigates the role of the library in addressing present and future challenges to bridge technical issues of conducting research in Bangladesh. An attempt has been made to identify the major problems for submission manuscripts in high impact journals and to indicate some possible solutions for developing research information management systems, and efforts to improve training and support for researchers to enhance the research productivity of researchers in Bangladesh. Finally, the study illustrates a real picture of scientific outputs of renowned organizations in Bangladesh using Scopus database.
Keywords: Research, Knowledge Management, Library Science, Database, Bangladesh

Introduction

Research and Development landscape of Bangladesh has grown tremendously over the last decade. The present Govt. of Bangladesh has taken various initiatives in improving its research, development and innovation activities. Research can make a significant contribution to the growth and development of any nation. Research and the library are closely interconnected with one another. Librarians continue to play a vital and critical role in conducting research and are expanding beyond their traditional duties for delivering high quality information services to engage themselves more as educators, technological guides, and communicators. Librarians should pace more and more into a leadership role develop major initiatives and conduct training to increase research reproducibility. Libraries are no longer to run with the conventional resources

that researchers consult, and most libraries are now run to facilitate e-resources and to support faculties, researchers and students. In today's online world, in order to better support the research process, the librarians are in a leading position to proactively advance their integration for guiding the academic professionals to enable them to apply technology for enhanced teaching and research activities. Research support is of the utmost importance in academic and research libraries and the libraries must continually assess their research environment and their researchers in order to serve them appropriately. Hence, the study tried to evaluate the functioning of academic and special libraries through the core technical issues involved in research process. The present study is expected to examine in detail the performance of libraries in supporting research. The challenges revealed through the study would help the academic and research libraries in Bangladesh to identify the real strength and weakness of' their core values in supporting research. Finally, the study explores a real picture of scientific outputs of twenty-three renowned organizations in Bangladesh using Scopus database.

Literature Review

Academic and research libraries have an important role in the present research-based environment to support e-research of research cycle. The mission of these libraries in supporting the process of learning, teaching and research has been widely recognized globally. It is a fact that the value of research is very much dependent on the availability of well-organized and rich library collections in both print and online, innovative information services, ICT infrastructure, digital transformation and digital information infrastructures and continuing support of' the library staff for Research Data Management (RDM) in the entire research life cycle. Although there is already a rich and extensive body of literature investigating the research engagement of academic and special libraries particularly in the developed world, this study may be the first attempt to explore the various technical issues for successful research in Bangladesh scenario.

Hart and Kleinveldt conducted an experiment in 2011 to investigate through a questionnaire survey of 102 full time academic staff at the Cape Peninsula University of Technology in order to find out the role of an academic library in research. This study reveals that most of the researchers (over 65%) continue to rely on the library for access to print and electronic resources (Hart and Kleinveldt, 2011).

The study conducted by Fernández Marcial, Costa & González-Solar to explore the top ten world university libraries for continuing role of research in academic organizations and set the parameters to rank the excellence of top academic organizations, such as ARWU (Academic Ranking of World Universities) of the University of Shangai, SIR (SCImago Institutions Rankings) or the THE (Times Higher Education World University Rankings). It reveals that "*excellent universities have excellent library services and excellent libraries contribute effectively to excellent research universities*" (Fernández Marcial et al., 2016).

Renwick, Winter, & Gill in 2017 examined a study on managing research data at an academic library in a developing country through a pilot study of 100 researchers on the campus and analyzed that research data management is an important issue in many universities. Analysis of the 65 valid responses revealed that the researchers had little knowledge in managing owned data

sets and validated a role for the Campus Libraries to play in supporting researchers on campus (Renwick et al., 2017).

Brewerton illustrated a "researcher life cycle" approach was used to identify researcher information needs Research Libraries UK (RLUK) in 2010. The study indicated areas of recent activities by information specialists to deliver high quality information services. It also explored expertise sets essential for updated information services in supporting information needs of researchers (Brewerton, 2012).

Chiware & Mathe highlighted the importance of Research Data Management Services in the academic libraries of South Africa. The authors opined that Research Data Management (RDM) services are much crucial in academic and research libraries globally that support of university research activities (Chiware and Mathe, 2015).

The study developed by MacColl for supplying bibliometrics treated as the most obvious administrative role of academic libraries. The researcher advocated a core and standard role for libraries: to support research activity in all aspects of library services, to curarize, direct and uphold various scientific outputs of research activity (MacColl, 2010).

The management of research data is very much important for academic libraries today. Tenopir et al discover the available research data services (RDS) delivered by European academic research libraries and the possible research data services carried out through an investigation of directors of the Association of European Research Libraries (LIBER) (Tenopir et al., 2017).

Set out tools for data mining and visualization, assistance with creating data management plans and metadata for data sets, development and management of institutional repositories, guiding for library research users on data authentication activities, direction on institutional policies, and assist with intellectual property and privacy issues adjacent research data are the fundamental activities as revealed by Flores et al. (Flores et al., 2015).

Lessick opined that engagement of health science librarians for supporting research is a little-studied question. The study showed that Hospital librarians were significantly less likely than academic librarians to have participated in research activities (Lessick et al., 2016).

Searle, Wolski, Simons, & Richardson investigated a study focused on research data service development at Griffith University, Australia. The authors identified four key areas for research data service development i.e. Policy, infrastructure, Advisory services and Developing knowledge and skills (Searle et al., 2015).

Schmidt, Calarco, Kuchma, & Shearer explored four core new innovative services of research libraries such as development of research data management plans, hosting collaborative virtual research environments, managing institutional repositories, and disseminating research outputs through open access mechanisms (Schmidt et al., 2016).

Schmidt described the current state of Canadian university health sciences librarians' knowledge about systematic reviews (SRs). The study found that over half of the librarians involved in SRs

who are participating in a traditional librarian role (e.g., search strategy developer); less than half indicated participating in any one nontraditional librarian role (e.g., data extractor) (Schmidt et al., 2016).

Objectives of the study

The main objective of the study is to identify the basic technical issues of research life cycle and highlights the librarians' competencies for research support of Bangladesh for guiding researchers s. Some of the imperative aims and objectives were as follows:

- Use of academic and research libraries to assist in research information seeking, and the role and value of the library services in support of research
- How researchers' do interact with library services for conducting research
- The services and resources recommended to support research, including advice on using research papers: Citations, Referencing and Plagiarism
- Covers the role of the library in addressing present and future challenges to bridge technical issues of conducting research in Bangladesh
- Illustrate a real picture of scientific outputs of twenty-three renowned academic and research organizations in Bangladesh

Research Methodology

This study is mainly based on the personal observations and experiences of the authors. Both qualitative and quantitative methods have been carried out to retrieve various data. Scopus and Web of Science database have been used for retrieving publications data of various organizations cover this study on 26 August, 2018. Exchanged views, shared opinions, and then decided to describe our understanding of current situation of various technical issues of research. Additionally, reviewed web sources, journal articles, workshop outputs, and direct observations in assessing the current situation. Databases searched included Library, Information Science & Technology Abstracts (LISTA), Google Scholar, ScienceDirect, PubMed, and Emerald. Search queries were tailored for different databases according to their respective controlled vocabularies:

a. ["Research support" OR "academic libraries*" AND role] for LISTA, Google, Emerald, and ScienceDirect
b. ["information professional" OR "academic librarian*" AND "Research Data Services"] for ScienceDirect and Google Scholar
c. ["Research librarian*" AND role] for LISTA, Google, ScienceDirect, and Emerald
d. [("libraries, academic OR research" [MeSH] AND "librarians" [MeSH]) AND "research role" [MeSH]] for PubMed

Quantitative data were analysed using Microsoft Excel spreadsheet, and qualitative data were analysed using thematic analysis. The investigators have also used EndNote X8 software for managing the references in this article.

Research and Research Cycle

Research has been defined as “creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications” (Frascati, 2002). Richardson defined as *“The research cycle is generally considered to contain four main elements: idea discovery; funding/approval; experimentation; results dissemination. It is critical that librarians are fully familiar with the activities their researchers are engaged in so that they can ascertain the depth and breadth of the role they need to play. QULOC (Queensland University Libraries Office of Cooperation) (2012) has produced a comprehensive research life cycle model that reflects the research librarian’s role at each stage*.” Examples of some of the activities that may require support include (Richardson et al., 2012):

- *“Idea discovery: writing the literature review; developing collections; providing research training; enhance information literacy*
- *Funding/approval: support with grants and funding*
- *Experimentation: data curation; research data management; metadata*
- *Results dissemination: institutional repositories; open access; bibliometrics; theses; research assessment; support for publication.”*

Current Scenario of Research in Bangladesh

Bangladesh, being one of the most developing nations in South East Asia, must be given more and more emphasis into the area of research and development, and innovation. In order to remain competitive, Bangladesh needs to constantly generate and establish new sources of economic growth which can be achieved through the development of science, technology and innovation (Lessick et al.) through research and development (R&D) programmes. Global Innovation Index 2018 reported that Bangladesh ranked 116th, the lowest in South Asia while Switzerland is ranked as the world's most innovative country (Cornell University and World Intellectual Property Organisation (WIPO), 2018). The performance of Bangladesh in research and innovation is not in a standard level compared to many LDCs. The "Ranking Web of World Research Centers" and The "Webometrics Ranking of World Universities" are the major initiatives of the Cybermetrics Lab, a research group belonging to the Consejo Superior de Investigaciones Científicas (CSIC), the largest public research body in Spain, which ranks the academic and research institutions of the world based on various different sets of indicators adapting the quantitative studies about the scientific and research output through electronic journals and repositories, and the impact of the Open Access initiatives. The top 10 Bangladeshi Universities and Research Organizations ranked by CSIS are presented in Table 1 and Table 2 respectively (CSIC, 2018b, CSIC, 2018a).

Table 1: Top 10 Bangladeshi Research Organizations

ranking	World Rank	Institute	Size	Visibility	Rich Files	scholar
1	343	International Centre for Diarrhoeal Disease Research Bangladesh (Centre for Health and Population Research)	1717	687	342	656
2	2413	Bangladesh Rice Research Institute	4277	4151	2026	2848
3	2731	Bangladesh Agricultural Research Institute	2903	3718	2226	3251
4	3014	Bangladesh Institute of Development Studies	3153	3989	2627	3251
5	4277	Bangladesh Institute of Nuclear Agriculture	4927	4768	2967	3609
6	4393	BRAC Research and Evaluation Division	2602	4470	3254	3400
7	5397	Bangladesh Livestock Research Institute	5887	5227	2800	3957
8	5871	Bangladesh Agricultural Research Council	6046	4295	3254	3957
9	6054	Bangladesh Fisheries Research Institute	4123	4715	3254	3957
10	6608	Bangladesh Forest Research Institute	6336	5450	3254	3957

Table 2: Top 10 Bangladeshi Universities

ranking	World Rank	University	Det.	Presence Rank*	Impact Rank*	Openness Rank*	Excellence Rank*
1	3013	Independent University Bangladesh	»	3924	5272	1644	3381
2	3031	Bangladesh University of Engineering and Technology	»	854	4398	11401	1829
3	3394	North South University Bangladesh	»	9948	7021	2235	3414
4	3455	Khulna University of Engineering & Technology	»	3333	7905	1881	3522
5	3584	Shahjalal University of Science & Technology	»	4108	8047	2971	3482
6	3628	Mawlana Bhasani Science & Technology University	»	838	7430	4940	3591
7	3720	Rajshahi University of Engineering and Technology	»	16751	10172	3674	2835
8	3791	American International University Bangladesh	»	5696	8346	2753	3735
9	3794	Khulna University	»	12207	9839	3562	3150
10	3881	Rajshahi University	»	5081	6734	11401	2383

The Scholarly publication status using Scopus database of major 10 organizations in Bangladesh are explored in Figure 1.

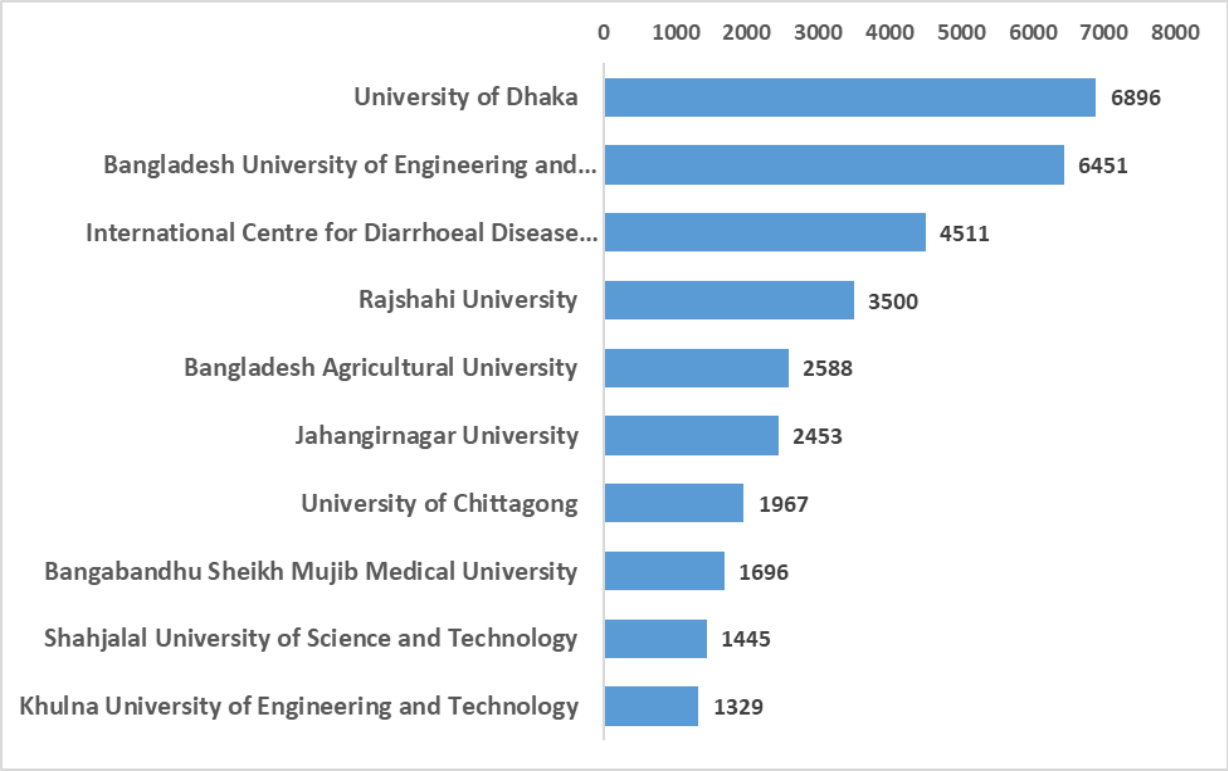

Figure 1: Scholarly publication status using Scopus database of major organizations in Bangladesh

Coverage of Technical Issues

Recent advancements in ICTs are profoundly changing the research landscape and the mission and vision of academic and research libraries in the 21st century to a great extent. The emergence of digital information resources in Web, compelling librarians approaching new technical issues, such as assisting with the development of diversified online information resources, bibliometric and webometric databases, hosting collaborative virtual research environments, managing institutional repositories, and publishing research outputs in high impact journals (Schmidt et al., 2016). Technical issues are treated for this study as the advanced level of skills and competencies of librarians for providing innovative research support to the researchers/scientists effectively and efficiently which include:

- Online information resources in network/Digital environment
- Research4Life programme
- Digital Access to Research (DAR)
- Proper referencing and citations
- Reference management software
- Checking plagiarism & Plagiarism software
- Predatory journals
- Web of Science, Scopus, and SciVal

- *h* index
- Journal Impact Factor
- Measuring usage of e-resources
- Research Support Services by Library

Online information resources in Network/Digital environment

At present, there is an extraordinary growth and diversification of online resources in the network environment which support the discovery, creation and use of information resources. The first and foremost Consortium named 'Bangladesh INASP-PERI Consortium', now functioning as LiCOB(Library Consortium of Bangladesh) developed in 2007, which is supported by INASP and coordinated by BAS. At present there are more than 53 organizations in Bangladesh working with this Consortium. The second Consortium UGC Digital Library (UDL)guided by Bangladesh University Grants Commission and funded by the World Bank launched in 2012 in order to make electronic resources subscriptions easily available for the universities of Bangladesh. Increasingly, the library facilitates access to a wide range of network resources alongside access to its owned or licensed collections. Some great varieties of Online information resources in Network/Digital environment are shown in Figure 2.

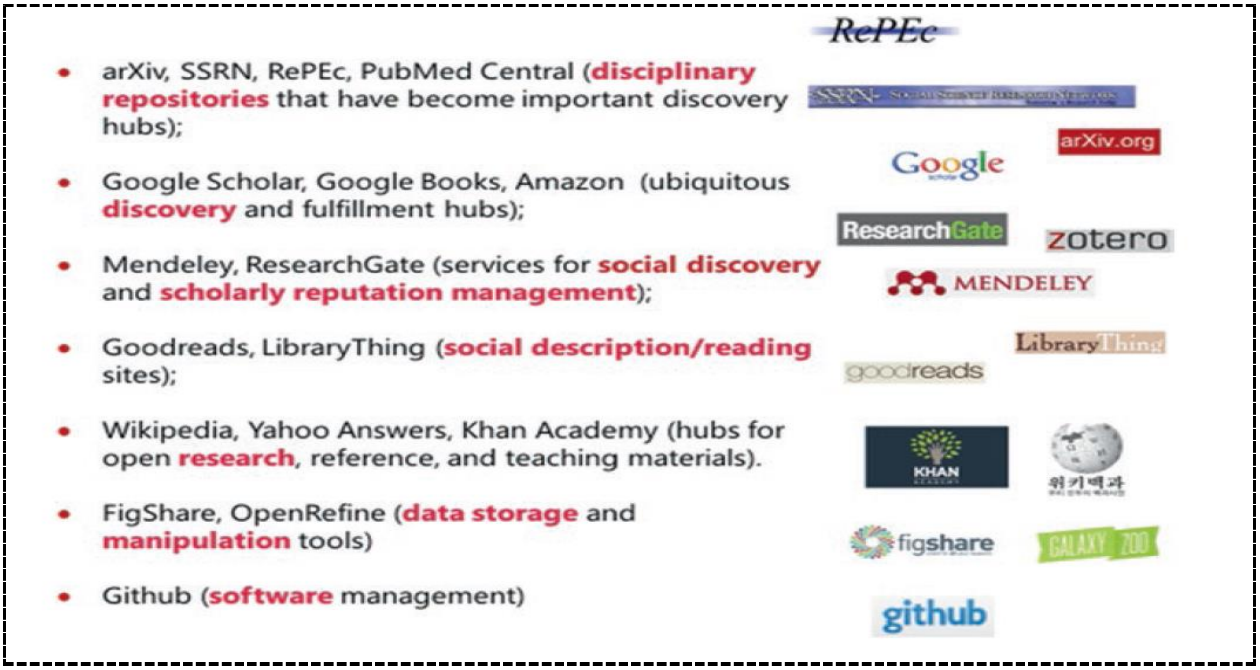

Figure 2: Examples of online information resources. Source:(Dempsey and Malpas, 2018)

Research4Life programme

Research4Life is enabling academic institutes, special and research institutes and government organizations with free access to scientific knowledge. Reducing the digital divide between high-income countries and low- and middle-income countries is the main vision of Research4Life (Uddin et al., 2017). The Research4Life website points out that "*since 2002, the five programmes – Research in Health (Hinari), Research in Agriculture (AGORA), Research in the Environment (OARE), Research for Development and Innovation (ARDI) and Research for Global Justice (GOALI) – have accessed researchers at more than 8900 institutions in more than 120 low- and*

middle-income countries with free or low-cost online access to up 90,000 leading journals and books" (Research4Life, 2019).

Digital Access to Research (DAR)
DAR is recently added in Research4Life Partner Programme. The United Nations officially declared the Technology Bank, a new body dedicated to least developed countries (LDCs) on 22 September 2017. Its main aim is to improve the use of scientific and technological information solutions for the world's least developed countries.

Proper referencing and citing
Referencing is also a way to give credit to the writers from whom a researcher has cited words and ideas. By citing the work of a particular scholar, one can acknowledge and respect the intellectual property rights of that researcher as well as avoid plagiarism. A researcher must properly acknowledge all the contributions that he/she has cited in his/her manuscript. Accurate and consistent citation is essential in all academic work. Citing is referring to someone else's work or ideas in the text of a researcher's work. It is often called in-text citing.

Reference management software
The leading Reference management software includes: RefWork, EndNote, ProCite, Reference Manager, Papyrus, Mendeley (Free downloadable from https://www.mendeley.com/) and Zotero (Free downloadable from http://www.zotero.org/)
Checking Plagiarism & Plagiarism software
University of Melbourne defines "*Plagiarism as the act of representing as one's own original work or the creative works of another, without appropriate acknowledgment of the author or source*." The leading Commercial Plagiarism Software are iThenticate, Copyscape, Grammarly, Writecheck, Plagscan, Turnitin etc. and Free Plagiarism Software includes Anti-Plagiarism, DupliChecker, PaperRater, Plagium , PlagTracker, Viper and Plagiarism Detector.

Predatory Journals
Journals have been termed "predatory" when they present a seemingly authentic face for an illegal publication process that lacks basic criteria of journal standards, sound peer-review practices, or an original basis in publication ethics (Beall, 2012). A predatory journal also pretends to be as legitimate by having a questionable editorial board and by providing "impact" measures that are not recognized by, for example, Scopus, Web of Science or Scimago.

Web of Science, Scopus, and SciVal
Web of Science, originally developed by the Institute for Scientific Information, now owned by Clarivate Analytics, is an online payment-based scientific citation indexing service that provides an exclusive literature search of research data sets, all in all totaling over 33,000 journals. It is also used for creating author's Identification Number, find out *h-index* of authors and Journal Impact Factor of high impact journals and creating citation analysis.

Scopus, the largest curated abstract and citation database of peer-reviewed literature, features smart tools to track, analyze and visualize global research that covers more than 5,000 publishers, over 71million records and 23,700 titles.

SciVal offers quick, easy access to the research performance of 4,600 research institutions and 220 countries worldwide. SciVal enables a researcher to navigate the world of research and devise an optimal plan to drive and analyze your performance.

h index

Wikipedia defines the h-index as "*an author-level metric that attempts to measure both the productivity and citation impact of the publications of a scientist or scholar*." Sometimes called the Hirsch index or Hirsch number.

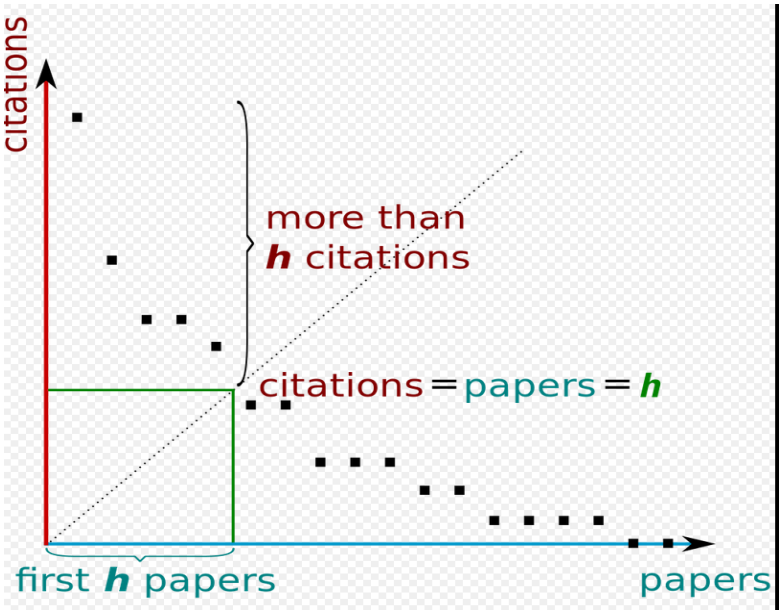

Figure 3: h index calculation Source: https://en.wikipedia.org/wiki/H-index

Journal Impact Factor

The Journal Impact Factor is defined as "*all citations to the journal in the current JCR year to items published in the previous two years, divided by the total number of scholarly items (these comprise articles, reviews, and proceedings papers) published in the journal in the previous two years*." (Clarivate analytics, 2019)

Measuring usage of e-resources

A comprehensive and reliable measurement of the use electronic resources is much more essential in order to improve the counting of e-resources in a library. The most notable models for measuring usage of e-resources are listed below:

- Project COUNTER – Counting Online Usage of Networked Electronic Resources (http://www.projectcounter.org)
- NISO – National Information Standards Organization – NISO Z39.7 Library Statistics (http://www.niso.org)

- ISO – International Organization for Standardisation – ISO 11620 Library Performance Indicators (http://www.iso.org)

- SUSHI: Standardized Usage Statistics Harvesting Initiative (National Information Standards Organization--Standard Z39.93)
- ICOLC – International Coalition of Library Consortia (http://www.library.yale.edu/consortia)

Research Support Services by Library

The predominance of the research is treated as one dominating parameters for academic and research organizations. So the academic and research libraries must provide excellent research support services to the faculties and researchers. The most notable research services are listed below:

Table 3: Research Support Services by Library

1. Research Support Link
2. Selective Dissemination of Information
3. Advanced Reference Services
4. Research Support Training
5. Research information literacy
6. Scientific Writing Support
7. Institutional Repository (IR) Management
8. Open Access Support
9. Information Evaluation
10. Checking Plagiarism and Reference Management
11. Special Documents Support
12. Research Data Support
13. Embedded Librarian
14. Finding journals for publishing research outputs
15. Research Metrics
16. Find out Journal Impact Factor and *h* index
17. Support with research grants and funding
18. Institutional Cooperation
19. Systematic Review
20. Digital Humanities

Skills required by librarians

Since academic and research libraries provide high quality research services, the library staff must keep pace themselves with new research skills and competencies**.** The RLUK survey of 22 libraries conducted in 2010 (Auckland, 2012) identified nine following skills of librarians specially for research support:

"*(1) Excellent knowledge of bibliographic and other finding tools in the discipline/subject.*
(2) Excellent skills to design information literacy training (both face to face and online) to meet the identified needs of different types of researchers.
(3) Outstanding skills in information discovery, literature searching etc.
(4) Knowledge to advise on citing and referencing, and the use of bibliographic management software.
(5) Ability to pro-actively advise on and market appropriate library services to researchers.
(6) Good knowledge of data sources available in the discipline/subject.
(7) Excellent knowledge of content available in the discipline/subject.
(8) Awareness of current and changing local research interests.
(9) Ability to gain an appreciation of individual researcher/project needs, including effective listening skills."

Lewis (Lewis, 2010) has identified a number of potential roles for librarians in Research Data Management (RDM) as explored in Table 4:

Table 4: Librarians' roles in RDM and required competencies mapped to existing roles

Role	Alignment with existing roles	Competencies required
Bring data into undergraduate research-based learning, promoting data information literacy	Information literacy training	Understanding of RDM best practices as they apply to relevant disciplines; pedagogic skills
Develop researcher data awareness		
Provide advice as above through a Web portal	Library Web site	Knowledge of institutional and extra-institutional resources
Signpost who in the institution should be consulted in relation to a particular question	Role of library as point of enquiry and the reference interview	Knowledge of institution
Promote data reuse by making known what is available internally and externally; explaining data citation	Marketing of library resources	Knowledge of researchers' needs, knowledge of available material
Audit to identify data sets for archiving, create a catalogue of materials or to identify RDM needs	Metadata skills	
Develop and manage access to data collections	Collection development, digital library management and metadata management	Audit interviews, knowledge of RDM principles, metadata, licensing

Findings of the Study

In order to reshape the research landscape in Bangladesh, the research librarian needs to upgrade his or her skills and qualifications to be continually updated to ensure that researchers' needs are being met. Librarians have to become involved in new competencies for research, such as research data management and curation, digital library management and metadata management, research data services and so on.

Scientific outputs of Academic & Research Universities/Institutes in Bangladesh

The academic and research libraries are by their nature critical stakeholders in research data preservation and management now and into the future. Research data is an essential part of the scholarly record, and management of research data is increasingly seen as an important role for academic and research libraries. The Scientific outputs of Academic & Research Libraries in Bangladesh during 2008-2017 using Scopus Database are explored in the following Figures numbering 5-7.

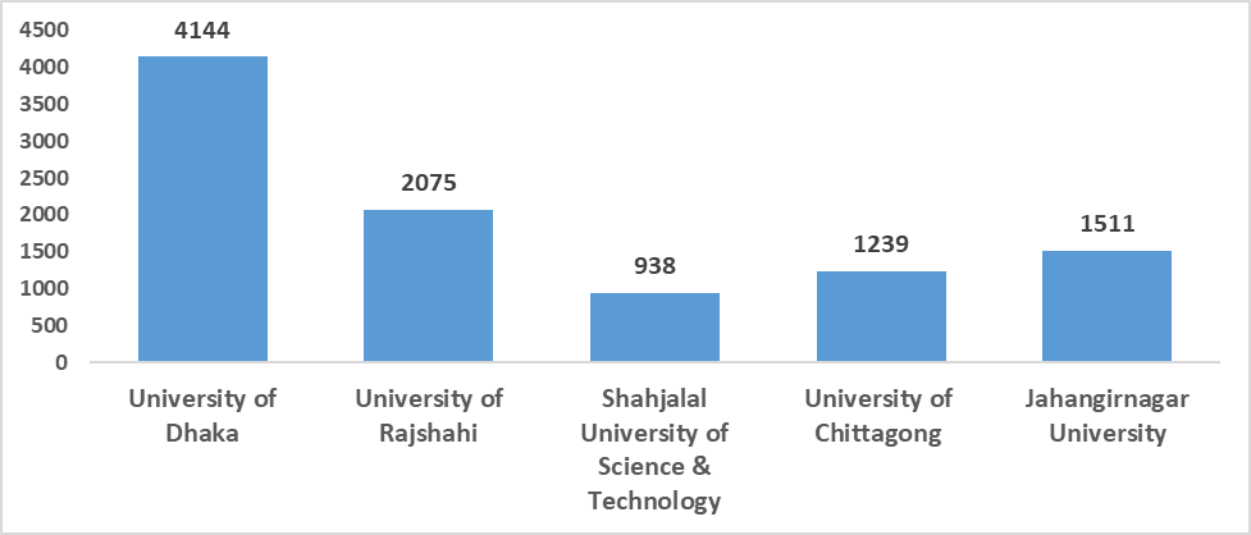

Figure 4 : Scientific Publications of major Public Universities in Bangladesh

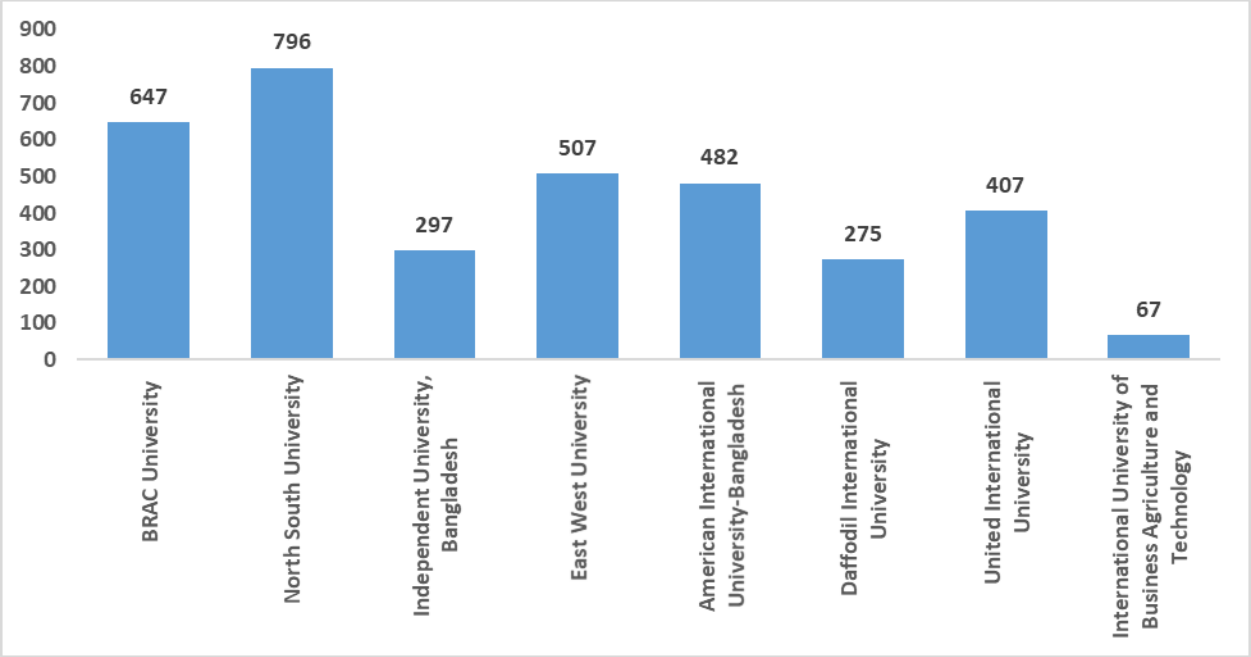

Figure 5: Scientific Publications of major Private Universities in Bangladesh

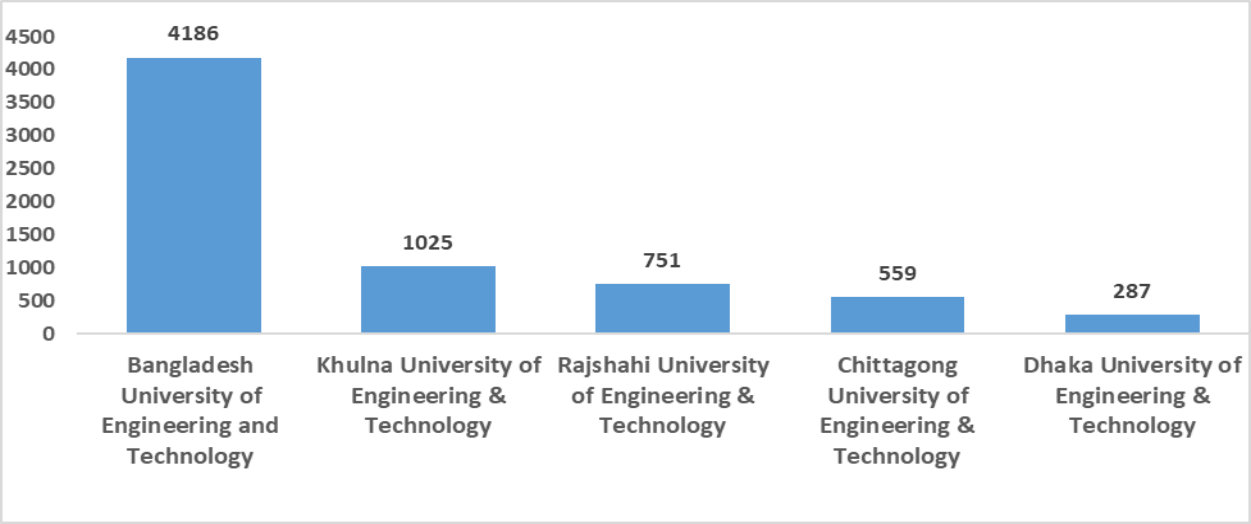

Figure 6: Scientific Publications of major Engineering Universities in Bangladesh

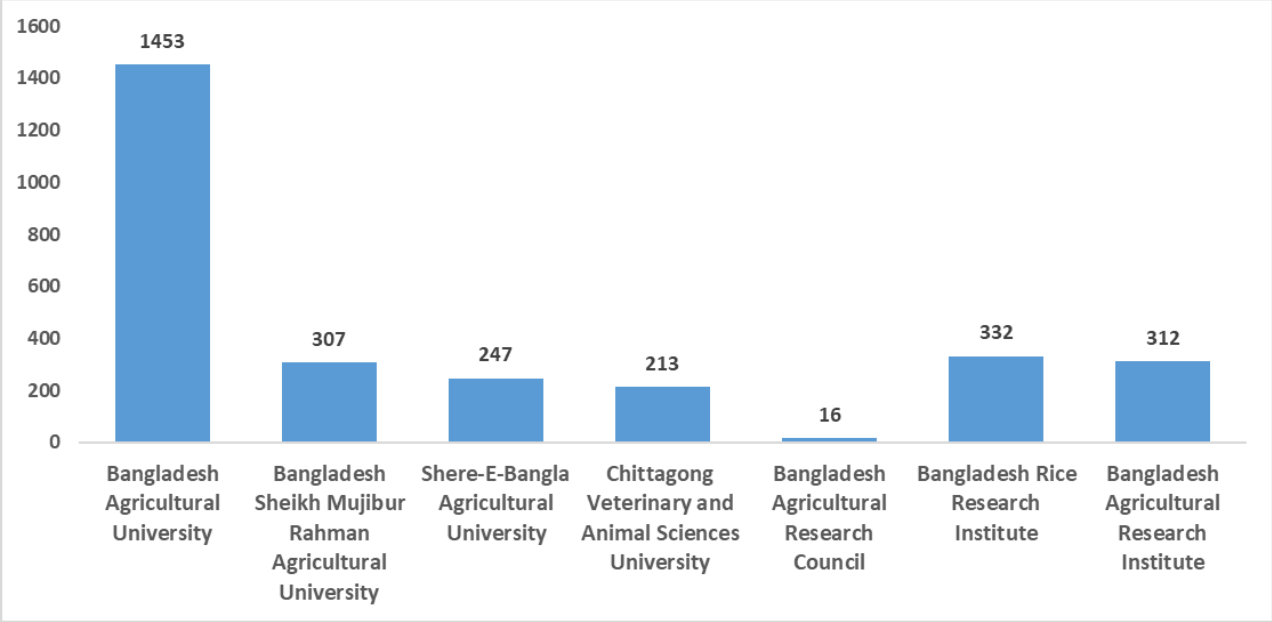

Figure 7: Scientific Publications of major Agricultural Institutions in Bangladesh

Challenges for Libraries to Support Research

In present electronic resources based environment, information seeking behavior of scientists and academicians is being greatly changed. Academic and research libraries have key activities to support their researchers in the areas such as Web, online databases, and online information literacy level. The core challenges of academic and research libraries are highlighted below:

1. Online information literacy skills for users available on the Internet
2. Procuring to the most important online databases for researchers such as Web of Science
3. Provide training programs for increasing research skills
4. Maintain strong communication with researchers and scientists
5. Necessary Research Data Services

6. Sufficient funds for e-resources
7. Lack of infrastructural facilities
8. Skilled LIS professionals
9. Developing web-based services

Recommendations

This study recommends the following recommendations for boosting up the research services in academic and research libraries:

1. Adequate and appropriate ICT facilities as well as internet bandwidth
2. Closely interact with researchers for research motivation
3. Developing policies for research support
4. Subscribing more online databases for e-books, e-journals and webometrics databases
5. Organize trainings, workshops and seminars to create adequate awareness among researchers
6. Provide Research Data Services to scientists
7. Developing research support centre for researchers
8. Establishing more IR
9. Implementing Library consortia for accessing digital resources
10. Sufficient library budget for subscribing e-resources

Conclusion

In present online based environment. Delivering high quality research data services are challenging, rewarding and expanding modes for academic libraries and related support services in academic and research arena in Bangladesh. There has been a wide expansion in research support services offered in academic and special organizations over the past ten years. Despite continuing challenges and budgetary constraints faced by academic and research libraries, it is of utmost importance that, these libraries must explore new innovative services for maintaining high research quality and scientific outputs public and private universities and renowned research universities and organizations in Bangladesh.

Acknowledgement

“This research study was funded by core donors which provide unrestricted support to icddr,b for its operations and research. Current donors providing unrestricted support include: Governments of Bangladesh, Canada, Sweden and the UK. We gratefully acknowledge our core donors for their support and commitment to icddr,b's research efforts.” (icddrb, 2019).

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