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Table of Contents

Open Access Repositories in Bangladesh and India: A comparative analysis

Md. Hasinul Elahi *
Dilara Begum **
M. Nasiruddin Munshi ***

Abstract

The objective of this study is to compare the present status of open access repositories in Bangladesh and India based on certain predetermined characteristics. Open Directory of Open Access Repositories (OpenDOAR) as a data-gathering instrument had been accessed for extracting the data from the period of 01-06 August, 2020. The results reveal that a total number of 108 repositories were registered in the OpenDOAR from Bangladesh and India in which India has more repositories than Bangladesh. The comparison between the repositories clearly indicates that Bangladesh is lagging behind in terms of developing OAR with only 14 repositories whereas India is leading the chart with 94. It is also evident that the repositories from India are more diversified in terms of content language which includes more than ten languages in comparison with only two in Bangladesh. In using software to manage the resources, the repositories from Bangladesh are using DSpace and Greenstone whereas diversified forms of software are being used in India. India is also far ahead in terms of the nature of content type and subject of the content in comparison to Bangladesh. The main drawback of the present research is that the findings are solely based on the data collected through the repositories indexed in OpenDOAR. The analysis of OAR of these two countries will help the library and information professionals to benchmarks their quality and also help in identifying issues to be addressed for fostering the growth of OAR.

Keywords

Open Access, Open Access Repositories, Bangladesh, India, Open Access System, OpenDOAR, Comparative study.

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* Senior Lecturer, Department of Information Studies and Library Management, East West University, Bangladesh
** Corresponding Author; Associate Professor and Chairperson, Department of Information Studies and Library Management; East West University, Bangladesh
*** Professor, Department of Information Science and Library Management, University of Dhaka, Bangladesh.

1. Introduction

The 40th President of the United States Ronald Reagan states that "Information is the oxygen of the modern age. It seeps through the walls topped by barbed wire, it wafts across the electrified borders" (Tolle, 2002 p. 47). It has been popularly said that "This is an age of information explosion". Due to the tremendous improvement in Information and Communication Technologies (ICTs) the availability, access and use of information have also increased. These improvements have a great impact on overall research output (Joint, 2008). But the availability and use of information are related to economic issues like purchasing, subscription etc. This theme has been changing gradually with the advent of open access system because information wants to be free (Brand, 1987). This has brought a revolutionary change in the field of research. The development in the field of ICT's caused a dramatic increase in journals, educational resources and easy availability of the research outcomes to the mass audience (Singh, 2016). Suber (2012) defines open access as:

> ''Open access (OA) literature is digital, online, free of charge, and free of most copyright and licensing restrictions.''

The Budapest Open Access Initiative (2002) defined Open Access as:

> [….] By 'open access' to this literature, we mean its free availability on the public internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. The only constraint on reproduction and distribution, and the only role for copyright in this domain, should be to give authors control over the integrity of their work and the right to be properly acknowledged and cited (Budapestopenaccessinitiative.org, 2002).

Open access repository can be defined as an online database available without any access restrictions and that makes the full text of resources it contains freely and immediately (Pinfield, 2005). Open access repositories play a crucial role in satisfying information need for a large community. Especially, it is a great initiative for the users of information and researchers of developing countries. The use of open access repositories has been widely

used in different institutions like libraries, information centers, government offices, industrial organizations etc. (Loan and Sheikh, 2016) in Bangladesh and India. Especially these two countries have taken several initiatives for the growth and expansion of open access repositories in their respective territory (Islam and Akter, 2013; Sahu and Arya, 2013). Thus, this study is an attempt to compare the present status of open access repositories in Bangladesh and India. Since these two neighboring countries work together on different projects, the comparative study may generate a sense of mutual co-operation regarding the development of open access repositories in both the territories. The rest of the study is organized as: background of the study, literature review, objectives, methodology, findings and discussion and finally conclusion with a brief summary of the study.

2. Background and significance of the study

Bangladesh and India are two neighboring countries. There is a historical relation between these two countries. India's relationship with Bangladesh are closely linked with civilization, culture, social aspects and economic sectors (Wikipedia, 2017). India has gained its independence in 1947 whereas Bangladesh in 1971. In the liberation war of Bangladesh, India had taken a strong stand for Bangladesh as well as mobilized the allies for gaining victory over West Pakistani army.

Features	Bangladesh	India
Independence	16 December 1971 (from West Pakistan)	15 August 1947 (from the UK)
Population	161,376,708 (2018 estimate)	1,352,642,280 (2018 estimate)
Literacy rate	**Definition:** age 15 and over can read and write **Total population:**72.9% Male: 75.7% Female: 70.1% (2017 est.)	**Definition:** age 15 and over can read and write Total population: 71.2% Male: 81.3% Female: 60.6% (2015 est.)
Education expenditures	1.5% of GDP (2016)	3.8% of GDP (2013)
Internet users	**103.476 Million (June 2020)**	696.77 Million (2020)

Table 1: A comparative analysis on the major features of Bangladesh and India (Source: Indexmundi, 2020)

Table-1 indicates a clear comparative analysis between Bangladesh and India in terms of independence, population, literacy, education expenditure, internet users etc. which will be helpful in determining the differences in the growth and expansion of open access repositories in these two countries. India is the largest among the south Asian countries. In terms of every characteristics discussed in the Table-1, India is far ahead. Therefore, this study will reveal whether they are ahead in the development of open access repositories or not. This will also be helpful for the country with relatively low performance in the development of open access repositories to benchmark themselves with the upper one and also will be able to identify the area in which they need to work on.

3. Literature review

Open access is a demanding issue of present time. Diversified issues related with open access system is a topic of concern for many researchers (Singh, 2016; Loan and Sheikh, 2016; Fox and Hanlon, 2015; Björk, 2013; Sahu and Arya, 2013; Shin, 2010; Utulu and Bolarinwa, 2009; Joint, 2008; Pinfield, 2005 etc.). The open forum is used as a popular platform for practicing, organizing and sharing information. Open access repositories collect, preserves and disseminate information in digital format which includes articles, preprints, post-prints, articles undergoing peer review, and theses and dissertations (Sahu and Arya, 2013). Due to long term benefits and enormous advantages the number of open access repositories are increasing day by day. The exact number of open access repositories varied in different studies. For example, according to Chan (2016), this number is Fourteen Hundred while according to OpenDOAR (2020) this number is Thirty Hundred. There are enormous open access institutional repositories have been created in Greece (Chantavaridou, 2018) as well as in Spain (Bravo and Díez, 2007), Korea (Shin, 2010), Czech Republic (Fabián, 2013) etc. These open access repositories contributed in the advancement of international research output (Joint, 2008). Although there are various difficulties of open access system in terms of language (Bowdoin, 2011; Chalabi and Dahmane, 2012; Tijssen, 2007), funding insufficiencies (McKay, 2011) and technological shortages (McKay, 2011; Nwagwu, 2013). If these obstacles can be eliminated, the effectiveness of open access system will be more visible. Singh (2016) identified the open access repositories in India while,

Shuva and Taisir (2016) indicated the present attitude regarding open access in Bangladesh. In India, the first open access initiatives had been taken in 1998. The first open access journal in India was 'Pramana'. After the emergence of open access journals, in the year of 2002 India's first institutional repository was created that is Eprints@IISc by TB Rajasekhar. CSIR had taken an initiative to build a combined open access repositories of thirty seven reputed laboratories of India (Subbaih and Muthu, 2011). In Bangladesh, open access is still in its development phase. The 'open access system' is developed in Bangladesh for removing the burden in subscribing to paid journals (Uddin, Koehlmoos and Hossain, 2014). They also identified that open access initiative had been started in Bangladesh by icddr,b. After that in the year of 2007, BanglaJol (Bangladesh Journals Online) was initiated with the aim to endorse the awareness level among the research scholars and use of Bangladesh-published journals in all fields by providing access not only to tables of contents and abstracts but also to the full text on the Internet. BanglaJOL is currently using the Open Journals System as a platform which is endorsed by the Public Knowledge Project (PKP) (Banglajol, 2020). In Bangladesh, the top public and private university libraries have been started to make their own open access institutional repositories. Islam and Akter (2013) considered institutional repositories as the first footstep towards open access to research output. But in maximum cases, the information regarding all these repositories are not registered to any international directory and at times also not accessible at all. Gul, Bashir and Ganaie (2019) provided an overview on the open access institutional repositories in South Asia. A comparative analysis of open access repositories between India and China was done by Loan and Mushtaq (2018) and Parabhoi and Dey (2019).

The above review of literature clearly depicts that there are several literature, studies and research has already been done on present status of open access repositories all around the world and also comparison of open access repositories between two countries. But no study found on the comparative analysis of open access repositories between Bangladesh and India. Thus, this study takes an initiative to provide a comparison of open access repositories between Bangladesh and India.

4. Objectives of the study

The specific objectives of the study are to:

1. Find out the year-wise development of open access repositories in Bangladesh and India;
2. Analyze the characteristics of open access repositories of Bangladesh and India by type, software used, subject, content type and language used.

5. Methodology

The present study adopts quantitative approach to conduct the research. The data were collected from OpenDOAR form 1-6 August, 2020. OpenDOAR provides a proper listing of open access repositories from all over the world and is supervised by SHERPA services which is based at the Centre for Research Communications at the University of Nottingham, United Kingdom (OpenDOAR, 2020). The scope of the present study is only confined to Bangladeshi and Indian open access repositories indexed in the OpenDOAR database. The reason to choose these two countries is to see the development of OAR in two neighboring countries who are closely linked with almost all aspects of social-economic development. From the stored list of repositories included in OpenDOAR, 'Bangladesh' and "India' under Asia were selected and data were collected. The OpenDOAR listed 14 repositories of Bangladesh and 94 repositories of India during the period of study (1-6 August, 2020). The necessary data about these open access repositories were collected manually and shifted to a Microsoft Excel file for tabulation and analysis purposes.

6. Findings and discussion

6.1. Trends of open access repositories in South Asia

From Figure 1 it is clear that India has got the maximum number of repositories that is 94 among all countries in Asia followed by Iran (18) and Sri Lanka (15). While Bangladesh has 14 open access repositories listed in the directory. There are some other countries which have very small number of open access repositories i.e. only 4 in Pakistan, only 1 each in Afghanistan and Nepal. In fact, the total number of open access repositories in India are more than China (Loan and Mushtaq, 2018; Parabhoi and Dey, 2019).

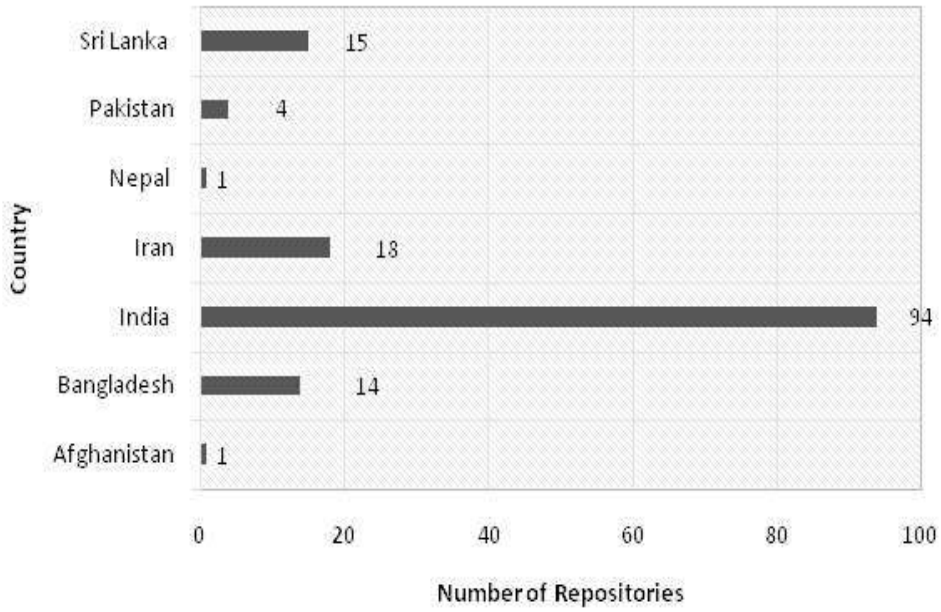

Figure 1: Open access repositories in South Asia

6.2. Year-wise growth of open access repositories in Bangladesh and India

The first repository of Bangladesh and India is enlisted in OpenDOAR respectively in 2008 and 2005 (Figure 2). Figure 2 shows the gradual development of repositories in Bangladesh and India from 2006-2020. There is a steady development in terms of increasing the number of open access repositories in both the countries. But in Bangladesh the number and growth of repositories are relatively slow than India. In the time frame of 2006-2008, eleven repositories were registered in OpenDOAR by India while only one repository was registered in Bangladesh. The same pattern can be seen throughout the year-wise growth.

6.3. Open access repositories types

OpenDOAR enlisted five types of repositories i.e. undetermined (The repository whose nature has not been evaluated), institutional (An institutional or organizational or departmental repository), disciplinary (A

cross-institutional subject repository), aggregating (The repository accumulating data from several subordinate repositories) and governmental (The repository form government data). Figure 3 reveals that there are mainly three types of repositories available in Bangladesh among which the number of institutional repository is maximum (12). But in case of India all the four categories of repositories are available. It clearly indicates that institutional repositories are growing and developing more in comparison to other types. Previous studies (Singh, 2016) also identified that the number of institutional repositories is quite big as compared with other types.

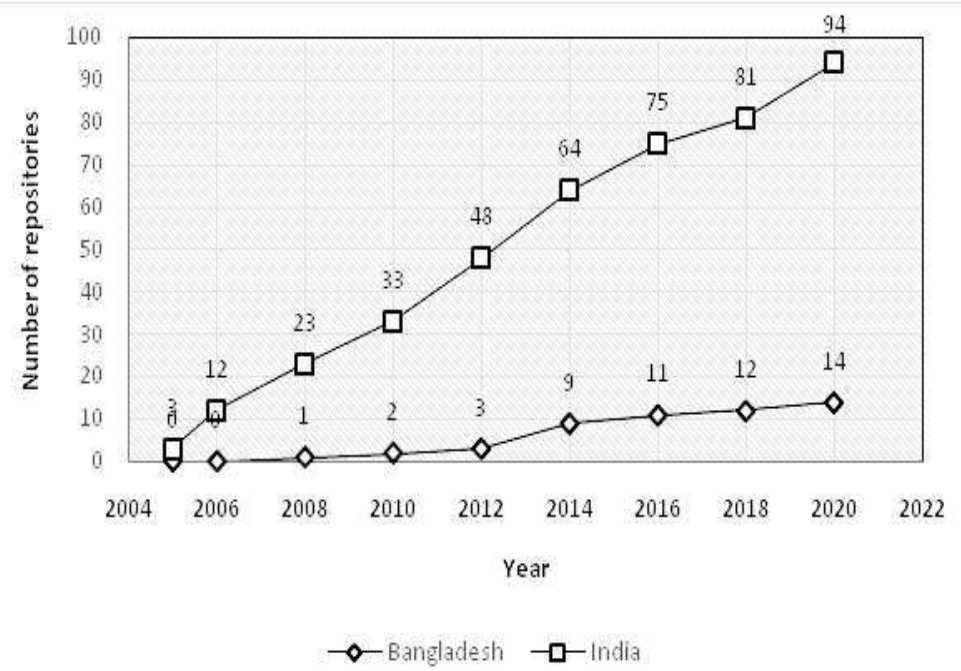

Figure 2: Growth of open access repositories in Bangladesh and India

6.4. Software used in open access repositories

Table-2 clearly reveals that mainly DSpace (86% in Bangladesh and 55% in India) software has been using by open access repositories of different institutions in Bangladesh and India. Although in India, almost seven other software (i.e. Nitya, CALIBRE, ePrints, Architexturez, Drupal, HTML, Metastudio etc.) are also using along with Greenstone and DSpace for maintaining the repositories. In Bangladesh, Greenstone is being used along

with the DSpace. Unique features of both these software i.e. user friendliness, advantages of import and export, convenient interface with easy browsing facilities, OAI-PMH interoperability etc. have made them widely popular for maintaining the repository (Ravikumar and Ramanan, 2015). DSpace and ePrints are not only popular among the South Asian open access repositories but also used in other territories as well (Pinfield et al., 2005).

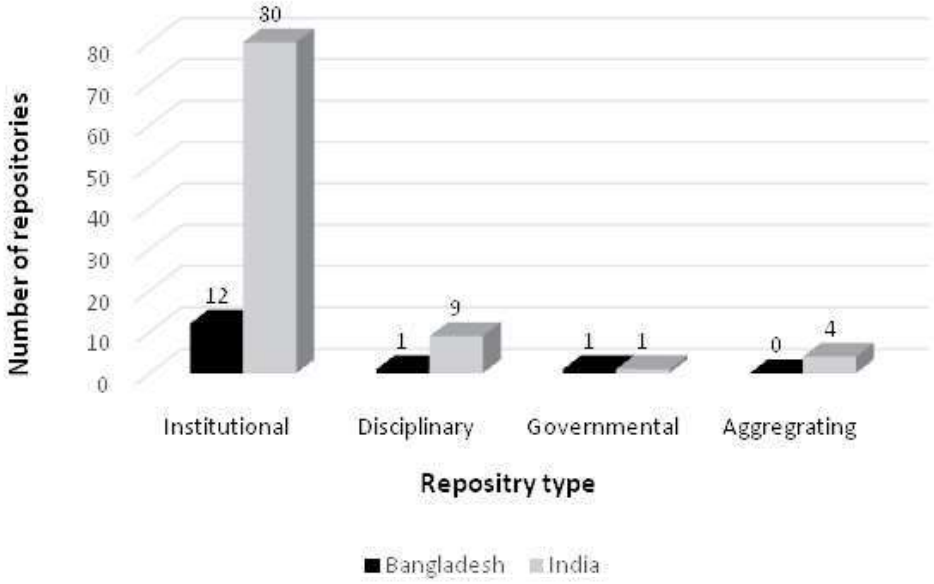

Figure 3: Comparison of open access repository types in Bangladesh and India

Software	Used in Bangladesh	Used in India
DSpace	12 (86%)	52 (55%)
ePrints	-	32 (34%)
Drupal	-	1 (1%)
Greenstone	2 (14%)	1(1%)
Others	-	8 (9%)
Total	**14 (100%)**	**94 (100%)**

Table-2: Comparison of open access repository software usage in Bangladesh and India

6.5. Language of open access repositories

"English" remains a prioritized language among the open access repositories in both the countries (Figure-4). It also indicates that content languages are diversified in India. In the open access repositories of Bangladesh, contents are found in Bengali language.

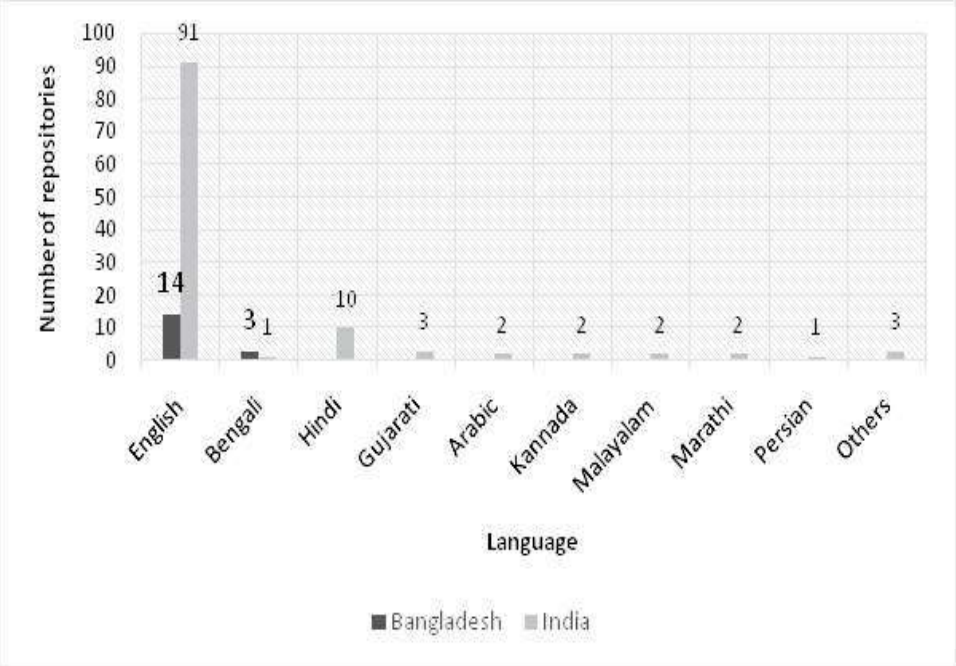

Figure 4: Comparison of operational satus of open access repositories in Bangladesh and India

6.6. Content Pattern of open access repositories

"Journal article" (10) and "Theses and dissertations" (10) form the majority of the contents of open access repositories in Bangladesh whereas in India "Journal article" (70) lead the content type followed by "Theses and dissertations" (49). Though "Reports and working papers" (9) and "Special item types" (6) are ranked two and three respectively in Bangladesh. In India, "Conference and Workshop papers" gained special attention in terms of content. It is also evident that in Indian repositories, there are some other content types, i.e. patents, datasets etc. which is not available in the repositories of Bangladesh.

Content Type	Bangladesh		India	
	Frequency	**Rank**	**Frequency**	**Rank**
Journal Articles	10	1	70	1
Theses and Dissertations	10	1	49	2
Conference and Workshop papers	5	4	45	3
Reports and working papers	9	2	30	4
Books, Chapters and Sections	4	5	34	5
Other special item types	6	3	27	6
Learning Objects	1	6	21	7
Bibliographic References	1	6	13	8
Patents	-	NR*	6	9
Datasets	-	NR*	3	10
Total	**46**		**298**	

Table 3: Comparison of content pattern of open access repositories in Bangladesh and India

*NR- No Rank

6.7. Subject diversification of open access repositories

Most of the repositories of Bangladesh (9) and India (45) have multidisciplinary subject approach. By analyzing OpenDOAR, it has been found that there are more subject diversification in Indian repositories in comparison to Bangladesh (Table-4). It is also evident from the findings that no contents has been found on the subject area like Chemistry and Chemical Technology, Mechanical Engineering and Materials, Physics and Astronomy, Ecology and Environment, Civil Engineering, Earth and Planetary Science, Psychology, Architecture in the open access repositories of Bangladesh.

Subject	Bangladesh		India	
	Frequency	Rank	Frequency	Rank
Management and Planning	2	4	3	11
Library and Information Science	2	4	6	8
Law and Politics	2	4	1	13
Education	1	5	1	13
Business and Economics	4	2	2	12
Social Sciences General	1	5	3	11
Language and Literature	2	4	1	13
Arts and Humanities General	2	4	2	12
Electrical and Electronic Engineering	1	5	7	7
Computers and IT	2	4	9	5
Architecture	1	5	1	13
Technology General	1	5	13	2
Health and Medicine	3	3	12	3
Mathematics and Statistics	1	5	5	9
Biology and Biochemistry	1	5	9	5
Agriculture, Food and Veterinary	2	4	7	7
Multidisciplinary	9	1	45	1
Chemistry and Chemical Technology	-	NR*	12	3
Mechanical Engineering and Materials	-	NR*	10	4
Physics and Astronomy	-	NR*	8	6
Ecology and Environment	-	NR*	6	8
Civil Engineering	-	NR*	5	9
Earth and Planetary Science	-	NR*	4	10
Psychology	-	NR*	2	12
Architecture	-	NR*	1	13
Total	**37**		**175**	

Table 4: Comparison of subject pattern of open access repositories in Bangladesh and India

*NR- No Rank

7. Conclusion

This study highlighted the present scenario of open access repositories in Bangladesh and India which are available in the OpenDOAR. It shows that the total number of repositories of Bangladesh that are indexed in OpenDOAR is very less in comparison to India. In general, the trend of development of open access repositories for India was quite similar to the trends of world repositories, where there was a quick escalation in the number of open access repositories in recent years. In contrary, the growth in the development of open access repositories in Bangladesh is very low. Since India is a large country with huge population it is clearly ahead. However, studies also indicated that the repositories of Bangladesh are steadily developing. With the development of the ICT infrastructure in Bangladesh, it is expected to change the present scenario drastically. The maximum number of the repositories are using English language contents and the most preferred software used are DSpace and ePrints. Open Access repositories may make research more accessible and visible, allowing for more usage and exchange of ideas between scholars in these two countries working in related fields. The review of repository sites is also expected to encourage the creation of open access repositories in terms of information technology advancements and the production of good, reliable information sources. These results may be used by repository managers to generate ideas for enhancing the repository's site output through global visibility. These repositories have a huge influence on these two countries' research performance. This is a matter of great hope that despite of enormous constraints in open access system, it is still developing. If the respective authority of the institutions from both the countries patronize open access repositories, it will surely develop immensely and will create a greater impact in education, research and development program of Bangladesh and India. Traditional Institutional repositories are needed to be transform into OAR for achieving this purpose. The promotion regarding OAR should be increased to make users aware about this. A proper marketing strategy should be formulated for respective institutions. Visibility to online platforms like OpenDOAR should be increased as well through registration. Both the countries can take initiatives for collaboration in developing the present status of open access repositories and can establish joint open access repository policy. This will be helpful for both the countries in fostering

collaborative education and research in the Asian territory. In addition, information and technology specialists will assist in this area, and Library and Information Managers (LIMs) must keep up to date on new innovations in this field and put them into practice on the daily activities.

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Towards Effective South Asian and International Collaboration in Library and Information Science Education and Research

Md. Anwarul Islam *
Naresh Kumar Agarwal **

Abstract

Collaboration is the act of people coming together to achieve common objectives. There has been growing interest for regional and international collaboration in the Library and Information Science (LIS) field. Such collaboration has been for education, research, or collaboration enabled by professional associations. However, there is a lack of prior research on regional collaboration opportunities for LIS education and research pertaining to South Asia, which has more than a fourth of the world population. Using the knowledge-creation model as a theoretical lens, this study investigates the current state of LIS education and research in South Asia; the opportunities for regional and global collaboration in LIS in the eight South Asian countries; and the possibilities for the future based on these collaboration opportunities. The study will help researchers and professionals from this region to know what they have, what they lack, and how they could grow, and benefit the member countries they come from and beyond.

Keywords

Collaboration; knowledge sharing; South Asia; Library and Information Science; education; research

Introduction

Collaboration is the act of two or more persons, organizations, or other groupings coming together to achieve goals of mutual benefit or interest. It

* Associate Professor, Dept. of Information Science and Library Management; University of Dhaka
** Associate Professor / Director, Information Science & Technology Concentration; School of Library and Information Science; Simmons University; Boston, Massachusetts, USA

helps pool resources and expertise and can have intrinsic rewards, based both on the process as well as the outcome. Shah (2012) defines collaboration as "an activity of multiple parties coming together to work toward a mutually-beneficial common goal" (p.4), and likens it to (one side of a) tug-of-war, where every individual in the team is contributing one's strength to pull the rope in a particular direction to win the game (Shah, 2012; Agarwal and Rahim, 2019). Collaboration is about "sharing and exchanging of knowledge and skills" to solve problems faster through collective effort (Ocholla, 2008, p. 469). Agarwal and Rahim (2019) identified a number of determinants for successful collaboration, which could relate to individuals and motivation, timing, and the organizational and regional environment.

Researchers and practitioners in many interdisciplinary and multidisciplinary research fields have been collaborating for a long time to address shared problems. Like other disciplines and research areas, there has been a growing interest for regional and international collaboration in the field of Library and Information Science (LIS) (Virkus, 2007; Chaudhry, 2007). This collaboration has taken several forms such as collaborative research between people in different universities, regions, or countries, joint research within international research groups, faculty and students-exchange programs, visiting fellowships, regional, country, and student chapters in professional associations, regional and international conferences, seminars, workshops, and many more. Collaboration in the LIS field can be broadly classified under three categories: collaboration in education, collaboration for research, and collaboration in education and research fostered through professional associations.

As an example of collaboration in education, three European universities, Oslo University College in Norway, Tallinn University in Estonia, and Parma University in Italy collaborated to develop the International Masters in Digital Library Learning program under the Erasmus Mundus scholarship (Wenger and Snyder, 2000). In another example, the School of Library and Information Science at Simmons University has "trained over 600 international students from more than 80 countries" since its founding in 1902 and has had international collaborations with St. John's University, Paris, Yonsei University, South Korea, and other countries where students are able to take courses at each other's campuses (Simmons University, n.d.).

For collaboration in research, many bibliometrics studies have shown that joint research and international collaboration has been increasing among LIS researchers and professionals internationally (Agarwal and Islam, 2020; Ronda-Pupo and Katz, 2018).The co-authors of this study also serve as an example of successful international collaboration when the first author, as a doctoral student in the Japan Advanced Institute of Science in Technology, wrote to the second author in 2013 about the possibility to collaborate. Since then, we have co-published more than 15 journal and conference articles.

Various LIS associations provide a fertile ground for collaboration among researchers, practitioners, and educators. The International Federation of Associations and Institutions (IFLA), a worldwide network of library and information professionals, offers training programs, workshops, conferences, and publication platforms for LIS professionals across the world (IFLA, 2021). Other associations such as the American Library Association (ALA), the Association for Information Science and Technology (ASIS&T), the Association for Library and Information Science Education (ALISE), iConference, etc. provide platforms to that help form a greater LIS community that can learn from each other and grow together (Agarwal and Islam, 2016; Agarwal and Islam, 2020).

Enabled by technology, there are many examples of regional collaboration for LIS education and training, including in the ASEAN region (Khoo, 2013), Gulf Co-operation Council (Al-Suqri, 2012), Africa (Ocholla, 2008), and Europe (Virkus, 2007). A few studies have focused on the South Asian region, but in the context of LIS education in the countries of this region (Phuritsabam and Devi, 2009; Singh and Wijetunge, 2006; Mangla, 1994). However, all of these South-Asian studies are more than a decade old and only discussed LIS education in this region. There is a lack of studies on regional collaboration opportunities for LIS education and research pertaining to the countries of the South Asian region.

South Asia is a region comprising eight countries: India, Pakistan, Bangladesh, Sri Lanka, Maldives, Nepal, Bhutan, and Afghanistan (Figure 1). The southern region of Asia, it is defined in both geographical and

ethno-cultural terms. Together, its population is 1.891 billion, which is more than one-fourth of the world's population. The name South Asia is represented in the regional grouping – the South Asian Association for Regional Cooperation (SAARC, 2018), which, since its establishment in 1985, has provided a platform for collaboration of these countries in different areas ranging from agriculture, education, women empowerment, cultural exchange, etc.

Figure 1: Countries of the South Asian region (source: Google Maps)

Objectives and Research Questions

The South Asian region has immense potential for further enhancing LIS education and research through knowledge sharing and collaboration. The primary objective of this paper is to investigate how LIS educators, researchers, and professionals in this region could benefit from regional and international collaboration. We have three specific research questions: *RQ1) What is the current state of LIS education and research in South Asia? RQ2) What are the opportunities for regional and global collaboration in LIS in different South Asian countries? RQ3) What are the possibilities for the future based on the collaboration opportunities?*

Answering these research questions would help LIS researchers and professionals in South Asia to know what they have, what they lack, and how they could grow, and also benefit the member countries they come from and beyond.

Literature Review and Theoretical Lens

Knowledge Management

Knowledge Management is the set of processes followed in an organization (may it be a for-profit company or a non-profit such as a hospital, library, or university, or even a professional association e.g., see Agarwal and Islam, 2016) in order to help improve efficiency and effectiveness and achieve organizational objectives. With technology, infrastructure, culture, and measures serving as enablers, there are several phases of the knowledge cycle – knowledge capture and creation, knowledge sharing and transfer, and knowledge application and use (Dalkir, 2017; Agarwal and Islam, 2016; Agarwal and Islam, 2014). The knowledge exchanged in these processes can be in one of two forms – tacit or explicit (Nonaka and Takeuchi, 1995). Tacit knowledge is something that resides in our heads and is learned through experience or observing by doing. Explicit knowledge, on the other hand, is codified in books, journals, online repositories, etc. where it is captured for potential future use. Only explicit knowledge can be exchanged through documents, while the more important tacit knowledge can only be exchanged through human interaction (Agarwal and Islam, 2014). In the distinction between information and knowledge, it might help in understanding to think of 'information' as explicit knowledge, and 'knowledge' as tacit knowledge. Both types of knowledge are important and interdependent, as seen in Nonaka and Takeuchi (1995)'s knowledge creation model, which we use as a theoretical lens for the study.

Theoretical lens

Nonaka and Takeuchi (1995)'s knowledge-creation model is also called the SECI model, where S is socialization, E is externalization, C is combination, and I is internalization. Each of these represents the point of conversion between types of knowledge. See Figure 2.

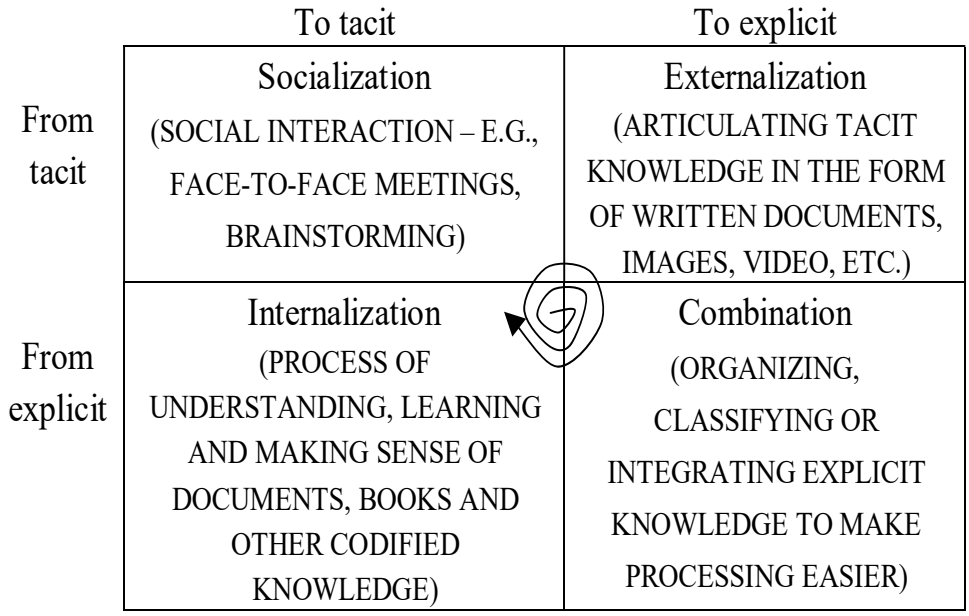

Figure 2 Nonaka and Takeuchi's (1995) model of knowledge creation in organizations

Tacit to tacit knowledge transfer or conversion happens during the phase of socialization (top left quadrant in the figure) such as synchronous face-to-face or online interaction. Converting tacit knowledge to explicit form is the process of taking one's internal knowledge and externalizing it in some written or recorded form (top right quadrant in the Figure). Explicit to explicit conversion happens when we choose to combine, summarize, visualize, or organize something that is already in the recorded form (bottom right quadrant in the Figure). Explicit to tacit conversion happens in the process of understanding – when we choose to internalize something in the written or recorded form e.g., when reading a book (bottom left quadrant in theFigure). The model shows how new knowledge is created in this manner within an organization. What it implies is that knowledge conversion, and thus, knowledge creation continuously takes place (the spiral shown in the model) within an organization in the simple processes of reading a book or an email (internalization), writing a letter or an email or a message (externalization), talking to someone (socialization), or writing an abstract or creating a table of contents to better organize a document (combination).

In this study, we apply Nonaka and Takeuchi's model in the context of effective regional and international collaboration in library and information science education and research in South Asia, and how such a collaboration can be understood by looking at the quadrants of the SECI model. Along with this lens, two other sources have been important. Shukla and Maurya (2018) help in understanding LIS research in South Asia, and Karisiddappa, Asundi and Lin (2018) list the LIS educational programs being offered in this region.

Current State of LIS Education and Research in South Asia

In this section, we discuss the history of the LIS education in South Asia, the current programs offered, and LIS research pertaining to this region.

A history of LIS education in South Asia

In South Asia, India has the oldest history of LIS education. In 1910, Maharaja Savajirao Gaekwad III of Baroda invited the American engineer-librarian, William Alanson Borden to create and direct a free public library system for the people of his state. Borden started the first training program for library workers at the Central Library in Baroda in 1911. A one-year postgraduate certificate program was launched in 1915 by American library pioneer Asa Don Dickinson at the University of the Punjab, Lahore. This was the first formal program in Asia and the second in the world after Columbia University (suspended in 1947 due to low enrollment, but revived in 1950). In 1929, S.R. Ranganathan introduced a certificate course at the Madras Library Association, which later moved to the University of Madras. In 1937, the course was converted to a one-year postgraduate diploma program. The first department of library science was established at the University of Delhi in 1946. It offered a postgraduate diploma in 1947 and a Master of Library Science in 1951 (which was renamed Master of Library and Information Science in 1972). A certificate course in librarianship was offered by the Dhaka University Library in 1952, but ran for only one session. The first postgraduate diploma program was established at the University of Karachi in 1956 (followed by the University of Punjab in 1959). In Sri Lanka, the first training on LIS was offered by the Ceylon Institute of Scientific and Industrial Research (CISIR) in 1957, and the postgraduate diploma on LIS was started by the University of Peradeniya. A Department of Library Science was established in 1959 at the University of

Dhaka with a post graduate diploma program (the department was renamed to the Department of Library and Information Science in 1987). The first Master's program was introduced in 1962 at the University of Karachi, where the first PhD program was offered in 1967. A PhD program in library science was approved by the University of Dhaka in 1978. In Maldives, the formal postgraduate diploma on LIS education was offered by Maldives National University in 2010. Today, while the number and size of LIS programs have grown in this region, some countries still have a minimal education in LIS. Nepal has one master's program in LIS offered by Tribhuvan University. Bhutan is in the preliminary stage of LIS education. Afghanistan does not have any LIS schools or associations at the national level. (Karisiddappa, Asundi and Lin, 2018; Kaur, 2015; Wijetunge, 2011).

LIS education in South Asia

Table 1 shows various LIS programs offered in the individual countries of South Asia, the number of universities offering them (more than 150), year first offered, and the number of LIS associations in these countries. The LIS schools and education in South Asia are quite different from those in the Americas and Europe in the aspects of accreditation, cultural emphasis, and other requirements.

Table 1. LIS degrees offered in South Asian countries

Country	Lis Degrees Offered	No. Of Univ. Offering	Year First Offered	No. Of Lis Associations	Source
India	All	128	1911	23	Ila (2021
Pakistan	All	09	1915	1	Malik and Ameen (2020)
Bangladesh	All	12	1959	2	Lab (2021)
Sri Lanka	All	2	1957	2	Karisiddappa, Asundi and Lin, (2017)
Maldives	Adv. Cert., Diploma	1	2010	1	De Alwis (2019)
Nepal	M.A.	1	1995	1	Tribhuvan University (2021)
Bhutan	Library Degrees Not Offered / Not Known				
Afghanistan					

All: B.A., M.A., M.Phil., Ph.D., Certificate, Diploma

LIS research in South Asia

LIS research and publication activities in South Asia has been captured in a few bibliometric studies. These studies show the existing status and growth of research here.

Siddique, Rehman, Khan, and Altaf (2020) conducted a bibliometric study covering sixty-two years (1957–2018), and saw a positive rising trend of LIS research in Pakistan, with national and international collaboration increasing and rising number of LIS publications in the last two decades. From four data sources – Web of Science, Scopus, Library and Information Science Abstract (LISA), and Library, Information Science and Technology Abstracts (LISTA), they selected 1,305 publications of Pakistani LIS researchers. The Department of Information Management, University of the Punjab was the most productive, Professor Khalid Mahmood was the top researcher with 133 publications, 'Library Philosophy and Practice' is the most popular journal, and 'Pakistan Journal of Information Management and Libraries' (PJIML) is the only journal that is indexed by the Scopus.

Sonkar (2020) analyzed LIS publications during 2014-18 in India and located 1,275 publications by Indian LIS researchers in the Web of Science. The study found continuous growth in LIS publications in India, with 'DESIDOC Journal of Library & Information Technology (DJLIT)' as the most popular journal. DJLIT, along with 'Annals of Library and Information Studies' (ALIS), is indexed by Scopus. National and international co-authorship and organizational cooperation is increasing. Gupta, BM (Emeritus Scientist) is the most prolific LIS author. Jawaharlal Nehru University and University of Delhi are on top in joint authorship of LIS publications. While authors from fifty countries published with Indian LIS researchers, USA became the top collaborator.

Past bibliometric studies on LIS research in Bangladesh are Khan et al. (1998) and Shuva and Ahmed (2007). In a study of LIS publications in Bangladesh from 1971-2020, Islam and Roy (2021) found 266 publications from Scopus and Web of Science. Department of Information Science and Library Management at Dhaka University and its faculty members have published the most in Bangladesh (with Professor S.M. Zabed Ahmed having

36 LIS publications). Publishing trends has shown positive growth during the last two decades. Of Bangladesh's two LIS journals, 'The Eastern Librarian' was launched in 1966, and 'Bangladesh Journal of Library and Information Science' (BJLIS) was launched at Dhaka University in 1998 (Ahmad, 1987; Khan, et.al., 1998). However, both journals are irregular and not indexed by Scopus, or listed in Scimago journal ranking (SCImago, n.d).

In the Sri Lanka context, Pratheepan and Suthakaran (2019) imported 1,057 LIS publications between 2009 and 2019 from Web of Science. There is positive publication growth since 2009. LIS researchers from Sri Lanka have published the most in 'The Electronic Library'. With ten publications, Surla D. has published more than others. The two Sri Lankan LIS journals, 'Journal of University Librarian's Association' and 'National Library Review' are not listed in the SCImago journal ranking (Chamani, 2008; SCImago, n.d).

In a scientometric study, Shukla and Maurya (2018) found that between 1996 and 2015, Nepal, Bhutan, Afghanistan, and Maldives collective publish in single digits and 1% of all LIS publications from South Asia. To promote LIS research in South Asia, Emerald started the 'Emerald South Asia LIS Research Fund Award' (£1,000) in 2019. The 2020 award was named in the memory of Dr H. Anil Kumar from India for his contributions to LIS (Emerald South Asia LIS Research Fund Award, 2020).

Opportunities for regional and International Collaboration in LIS – A Case Study of the South Asia Chapter of ASIS&T

Current LIS collaboration among South Asian countries

There are a few existing platforms for collaboration among South Asian LIS researches and professionals. These include consortia such as the Digital South Asia Libraries, the Digital Library Network of South Asia (DLNetSA), the Committee on South Asian Libraries and Documentation (CONSALD), and the Southeast Asia Library Group (SEALG). A number of conferences and workshops, extending to other countries within Asia, also provide avenues for LIS educators and professionals to meet and present their work. Examples of these are the Congress of Southeast Asian Librarians (CONSAL), the International Conference for Library and Information

Science Educators in the Asia Pacific Region (ICLISE), International Conference on Asian Digital Libraries (ICADL), and the Asia-Pacific Conference on Library & Information Education & Practice (A-LIEP). Apart from these, there have been limited avenues for collaboration among South Asian countries in LIS education and research.

ASIS&T South Asia Chapter: A platform for collaboration among LIS schools in South Asia

Founded in 1937, the Association for Information Science & Technology (ASIS&T) is the premier international association for researchers and practitioners from over 50 countries studying how people interact with information and technology, and innovating theories, techniques, and technologies to improve people's access to information (www.asist.org). Engagement opportunities in ASIS&T center around its committees, special interest groups (SIGs), regional chapters, and student chapters. For a long time, most regional chapters were centered in North America, with a chapter in Europe and in Taiwan. Coinciding with the ASIS&T move to go international, its name was changed from 'American Society for Information Science & Technology' to its current name in 2013. A year prior, the Asia-Pacific chapter was started.

In 2016, as Chair of the membership committee, the second author proposed starting a South-Asia chapter of ASIS&T, as one of the ways for ASIS&T to increase member recruitment and engagement in a populated region with 8 countries and one-fourth of humanity. The first author took on starting the South Asia chapter as his New Leaders Award Project in 2017 under the mentorship of the second author. At the 2017 Annual Meeting in Washington, D.C., both the authors met with Professor Kanwal Ameen from Pakistan and discussed forming the chapter. The first author and Professor Ameen went back to their countries (Bangladesh and Pakistan respectively) and actively recruited ASIS&T members. In 2018, the authors drafted the petition and by-laws for the formation of the South Asia chapter, got member signatures, and sent it to the ASIS&T Board for approval. The by-laws state that the Chair and the Chair-elect of the Chapter should be from different South Asian countries. This would allow different South Asian countries to lead the chapter. Professor Ameen (from Pakistan) became the inaugural Chair, and the

first author (from Bangladesh) was the Chair-elect and Co-chair of the newly-formed Chapter, and the second author served as the Advisor. Under the leadership of the first author, the chapter went on to win the ASIS&T Chapter of the Year in 2020. In 2020-2021, Dr. Bhakti Gala from India is the Chair, and Dr. Ruwan Gamage from Sri Lanka is the Chair-elect. The committee has representation from India, Pakistan, Bangladesh, and Maldives. There are no members yet from Nepal, Bhutan, and Afghanistan. To encourage increased membership in this region and beyond, the ASIS&T Board of Directors voted to provide free membership to information professionals from 78 Tier 2 developing countries according to WHO ranking (ASIS&T Tier 2, n.d.).

Currently, ASIS&T has 10 regional chapters and 39 student chapters in different universities (ASIS&T Communities, n.d.). Of these, the South Asia (ASIS&T South Asia Chapter, n.d.) and Africa chapters are the newest. Staring with 32 members in September 2018, and with 195 members in March 2021 and growing, the chapter provides a networking platform for South Asian information science professionals, help increase ASIS&T membership in South Asia. The networking opportunities take the form of webinars, presence in the ASIS&T Annual Meeting, regional conferences, seminars and workshops, and opportunities for collaborative research. In the short period since its founding, events where the South Asia chapter have joined hands have included the 2nd International Conference on Information Management & Libraries 2018 in Pakistan, Asia Pacific regional conference 2019 in Cambodia, Seminar on Archives, Libraries and Museums: Hubs of Preservation of Cultural Heritage 2019 India, International Symposium on Empowering Library and Information Professionals for Achieving the Sustainable Development Goals 2020, Bangladesh, and the National Institute of Library and Information Sciences (NILIS) Research Symposium on Challenges and Opportunities for Libraries in the New Normal 2020, Sri Lanka.

Discussion and Conclusions

Possibilities for the future based on regional and international collaboration opportunities in LIS

While the countries in South Asia have done well in establishing LIS education programs, and showing positive research trends in the recent decades, there is

tremendous opportunity for further growth in improving both the quantity and the quality of research and educational leadership coming from this region. The formation of the South Asia chapter of ASIS&T is only the fulfilment of the first dream for this region. LIS professionals in Nepal, Bhutan, and Afghanistan are yet to establish their presence in ASIS&T. The second dream is the leverage the South Asia chapter as a vehicle to improve research rigor to international standards, and increase the research and networking opportunities provided to students and other researchers in South Asia. Individual universities in South Asia could also follow the example of formation of the South Asia Chapter described in the previous section and form ASIS&T student chapters in their universities, which would work closely with the South Asia chapter.

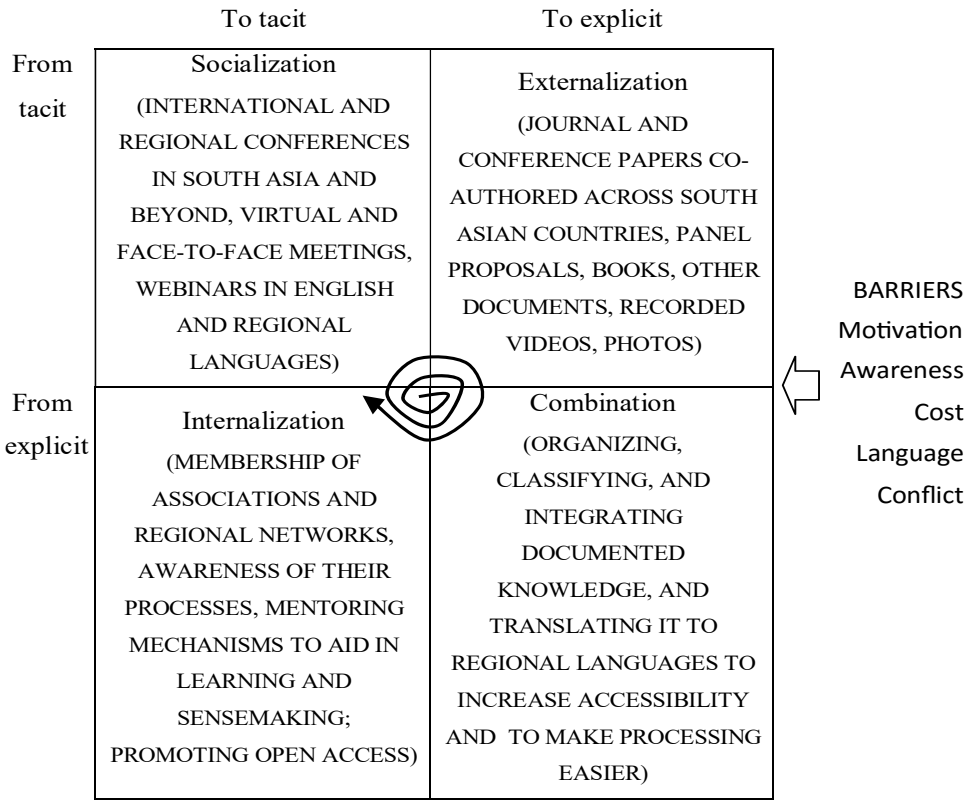

Figure 3 A knowledge-sharing model for LIS education and research collaboration in South Asia

In Figure 3, building on our theoretical lens of the SECI model, we present a knowledge-sharing model for LIS education and research collaboration in South Asia. The proposed model follows the SECI model in its four quadrants, the conversion of knowledge between tacit and explicit forms, and the spiral denoting the movement between these various knowledge creation processes. What is added in the model are barriers to collaboration and specific strategies for socialization, externalization, internationalization, and combination in the South Asian context that we discuss below.

1) *Opportunities for socialization:* Currently, there are a few socialization opportunities for South Asian researchers and practitioners to network and collaborate with each other for education and research listed earlier. Membership in premier international associations such as ASIS&T and IFLA and participation in their annual conferences would greatly increase the level and scope of opportunities afforded to LIS professional from this region. Regional conferences within South Asia, e.g., those sponsored by the ASIS&T South Asia chapter, would go a long way in bringing researchers in this regional closer. Motivation and awareness are barriers, which this paper aims to help bridge somewhat. Cost is a barrier, which is circumvented by travel grants and scholarships provided by associations (e.g., the annual travel grant by the ASIS&T SIG International Information Issues; Agarwal & Singh, in-press 2021, document the lives of 25 Indian students changed by a scholarship to study in Singapore which helped them discover their Ikigai or life purpose). Another barrier is language. Talks could be held in regional languages such as Bengali, Hindi, Tamil, Urdu, Sinhalese, Dhivehi, etc., apart from English. Lastly, political conflict within/among regional countries might limit/prohibit collaboration and travel within the region. In the years 2020-21, during the Coronavirus pandemic, many universities in South Asia successfully organized well-attended webinars where they invited international speakers.

2) *Opportunities for externalization:* Joint authorship of papers, panels, books, etc., and joint recording of videos and panels provide further opportunities for LIS professionals from different South Asian countries. This is greatly enabled by the easy availability of

conferencing tools such as Zoom, Google Meet, and Microsoft Teams. The second co-author started an initiative Project Oneness World (projectonenessworld.com) to bring interviews of people from all walks of life, and document the journeys of leading LIS authorities. ASIS&T also has an Oral History project where they interviewed information science pioneers (Williams, 2015). LIS professionals from South Asia would benefit from learning about the life and research journeys of these people.

3) *Opportunities for combination:* While there is a lot of research and educational material worldwide, libraries and universities of the South Asian region have been active in creating directories, digital libraries, and repositories of documents, publications, and media that would be of use to LIS professionals in their countries or the South Asian region. There are opportunities to increase awareness of these assets, improving websites for usability, and translating documents to media to regional languages to overcome the language barrier. A number of faculty are already starting YouTube channels to sensitize South Asian students of research methods (e.g., the YouTube channel 'Information, Education, and Research' started by Dr. Khalid Mahmood, and the channel 'Research Tube' started by Dr. Syeda Hina Batool, both from Pakistan).

4) *Opportunities for internalization:* This is where learning and understanding comes in. South Asian researchers face access issues to top journals. Promoting open access would go a long way in helping researchers. Collaboration, networking, and travel are ways to increase awareness which can sensitize students and young researchers in South Asia to various possibilities that they may not have been exposed to yet. Membership of ASIS&T and other associations, and its regional chapters e.g., the South Asia chapter, joining as officers and committee members, and attending the annual conference and other events, would help South Asian LIS professionals learn about the processes of how these large international organizations work. This would help them become active contributors and learn from the experience of researchers and experts worldwide. Towards this end, a mentoring mechanism

whereby an LIS international expert guides or collaborates with a student or faculty researcher from South Asia can be very helpful – the New Leaders Award by ASIS&T enables such a mechanism. The second author would also like to start a virtual fellowship whereby he works with about 5 LIS researchers from developing countries each year to collaborate and co-publish. The two authors of this paper are an example of such a collaboration for research whereby they have co-published more than 15 research articles since 2014 while being located and working virtually.

Using the knowledge-creation model as a theoretical lens, we have described the current state of LIS education and research, the opportunities for regional and global collaboration in LIS, and the possibilities for the future based on these collaboration opportunities for the eight countries in South Asia. The proposed knowledge-sharing model for LIS education and research collaboration in South Asia should be useful to information professionals to assess what they have, what they lack, and how they could grow and benefit from greater regional and international collaboration. However, the proposed model needs to be tested through empirical studies. Its primary impact will be when it is utilized practically to enhance collaboration for LIS education and research in the South Asian context.

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Adoption of Digital Devices and e-Resources in University Libraries of Bangladesh: A Reflective Study

Md. Mostafizur Rahman *

Abstract

This study intends to examine the trend of adoption of digital devices and e-resources in university libraries of Bangladesh. The researcher used a structured questionnaire for collecting data from 13 public and private university libraries in Dhaka city. The study results revealed that the most popular digital devices which have been adopted by university libraries in Bangladesh are- desktop and laptop computers, servers, smart cards, storage devices like portable hard disks and flash drives, input devices such as flatbed and handheld scanners and digital cameras, output devices namely, printers, speakers, headphones and multimedia projectors along with RFID technology. The respondent university libraries have access to 29 e-books and 48 e-journals databases and installed open source software Koha-ILS, SLiMS, DSpace and Green Stone for automation and digitization. The study suggested that the university libraries should apply adequate digital devices in operations and services, subscribe to ample e-resources, establish a national digital information network and facilitate trouble-free access to digital facilities and e-resources remotely without fee.

Keywords: Digital Device, e-Resource, Digital Facility, Library, University Library, Bangladesh.

Introduction

Digital devices are very popular and essential components that have fit into place in all activities of this modern world for their vibrant and adoptable attributes. These devices facilitate the storage of massive amounts of digital objects permanently and retrieve, communicate and disseminate of them in very high speed. They can convert printed documents into digital form, store

* Associate Professor and Head, Department of Library Management and Information Science; Royal University of Dhaka

the large digital documents in a tiny space, feasible to carry and manage them conveniently. These tools allow thousands of digital books, journals, data, media such as images, audios, videos to store, retrieve, track, convey, access and utilize them with the ability to search and interpret through digital technology from anywhere at anytime remotely. That's why these devices are very popular among the academic libraries and vastly adopting them for easy use and access to e-resources, enhance the facilities, automate the library management system and enrich the quality of library services.

Now-a-days, the academic library operations and services are fully dependent on digital devices and the most popular digital devices that are used in the libraries are- desktop and laptop computers, smart phones, tablets, e-readers, note-books, smart cards, storage devices like flash drives, portable hard drives, input devices such as scanners, digital cameras, output devices for example printers, speakers, projectors etc. (Chatkap, 2018).With the spread of internet access and its facilities, the university libraries were primarily focused on digital devices such as computers, routers, modems to access the internet and services provided on the internet. Afterward, it started to adopt some other digital devices such as MP3 players, gaming devices, interactive whiteboards, digital TVs, podcasts, vodcasts, peer-to-peer networking, content syndication, blogs and moblogs, photoblogs, wikis, tag clouds, and voice over IP. These days, the libraries are utilizing various tools of e-learning and content management systems, web conferencing, slide sharing, report cards, e-portfolios, virtual rooms, plagiarism detection, virtual worlds and online collaborative work spaces. Besides these, application of open source software and open content, social networking, collaboration and sharing, mobile technologies, new scholarship and peer to peer technologies are very common in the university libraries of the world today (White, 2008). Installation of RFID technology has facilitated the automation of library operations and services, made secures the library resources, reduced the workload of staffs and extended the services beyond the library hours. Internet enable library services have widened the facilities outside the library boundaries and eliminate the constraints of time of users. Although these high-tech devices and facilities have increased the efficiency and effectiveness of library operations and services but non-tech savvy users face various difficulties while operating high tech devices in the library. So,

proper trainings are required for users to gain the maximum benefits of using digital devices and facilities in the library (Chatkap, 2018).

Application of computers and digital devices like printers, floppy disks and CD-ROM of e-resources databases were started in the libraries in Bangladesh during 1980s (Rahman, 2020; Rahman, Rahman and Chowdhury, 2015; Roknuzzaman and Rashid, 2016) and the first individual institutional subscription of Jstor online Journals database was started by North South University (NSU) library and BRAC University (Chowdhury, 2012; Rahman, Rahman and Chowdhury, 2015) along with ACM Digital Portal, IEEE Digital Library and 17 titles of online Journals of Elsevier, Cambridge and Oxford University Press by NSU library in 2002 (Rahman, 2016). Whereas with the formation of Bangladesh INASP-PERI Consortia (BIPC) in 2007 and University Digital Library (UDL) Consortia in 2012, the number of subscription of e-journals and e-books databases have been increasing gradually and the models of subscription of e-journals and e-books databases have been shifted from yearly individual institutional subscription model to the perpetual and yearly subscription on the number of access points models. In 2000s, the digital cultural sprung up among the university libraries especially in private universities in Dhaka city so that NSU library started Certificate Course in Digital and Online Librarianship in 2004. The first institutional repository (IR) was launched using customized software NSU-LMS at NSU library in 2003 (Islam and Uddin, 2006; Rahman, 2016) whereas RFID technology was introduced in the university libraries in Bangladesh in 2011 (Rahman, 2019).

These days, digital devices along with e-resources are using in the university libraries for increasing efficiency of library system management, effectiveness of facilities and better access to services, although there are prevailing a host of challenges in utilizing digital devices and e-resources in the university libraries of Bangladesh. The earlier pieces of studies have included suggestions on ways to improve the current condition of university libraries in Bangladesh by establishing digital information networks, however, those studies were more or less based on published information and have not been supported by any comprehensive investigation on the present situation of information handling by university

libraries and actual requirements of the users. That's why the study on this field is essential to know how the digital devices and e-resources are utilizing in the university library operations and services, identify the challenges and suggest some remedial measures prevailing over the interferences of adopting essential digital devices and e-resources in the university libraries of Bangladesh.

Objectives of the Study

Digital devices are adopting in the library operations and services to make easy access to digital resources, save the time, and extend the library facilities and services beyond the boundaries. Whereas, there are some challenges like inadequate digital devices, e-resources and skill manpower to adopt digital devices and facilities in the university libraries of Bangladesh. So the aims of this study are to examine the trend of adopting digital technology in the university libraries and put forward suggestions to overcome the problems and enrich the digital culture in the campus. Then, the general objective of this study is to explore the present situation of adopting digital devices, e-resources, digital facilities and services in the university libraries of Bangladesh and the specific objectives of the study are -

- To investigate which digital devices are being adopted in the university library operations and services;
- To know the use and access to online e-books and e-journals databases in the university libraries;To determine the current status of digital facilities and services in the university libraries; and
- To make recommendations to enhance the digital facilities and services in the university libraries of Bangladesh.

Research Methodology

This descriptive study followed the quantitative method of research and the data were collected through survey with a structured questionnaire and from library websites. Twenty two university libraries in Dhaka City on which nine public and thirteen private university libraries with readiness and relatively high IT potential were selected as sample population by random sampling method. From them, five public university libraries, namely, Bangladesh

University of Engineering and Technology (BUET) Library; Bangabandhu Sheikh Mujib Medical University (BSMMU) Library; University of Dhaka (DU) Library; Jagannath University (JU) Library and Sher-e-Bangla Agricultural University (SBAU) Library and eight private university libraries such as Ahsanullah University of Science and Technology (AUST) Library; American International University of Bangladesh (AIUB) Library; BGMEA University of Fashion and Technology (BUFT) Library; BRAC University (BRACU) Library; Daffodil International University (DIU) Library; East West University (EWU) Library; Eastern University (EU) Library and Independent University, Bangladesh (IUB) Library sent the duly filled out questionnaire back to the researcher during October 2020 to January 2021. The response rate was 59.09%. After the collection of data from thirteen participant libraries, it was verified and classified with the principles of research ethics, validity and reliability and analyzed the data by using standard descriptive and statistical methods.

Literature Review

Many researchers carried out studies on the reasons, impact, challenges and effectiveness of adopting digital devices in the library operations and services and published their results. This researcher has consulted those documents available in the libraries and e-resources on internet for collecting literature relevant to this study and presented their review below.

Whong and Zakari (2014) revealed that the reasons of adopting digital devices in the libraries are - these devices have dramatically enhanced information provision not only in the selection, ordering, acquisition, processing, storage and retrieval of library resources but also improved staff productivity, whereas Griffey (2018) found that digital devices help to run functions of libraries easier and faster with less number of staff, and automation using digital technologies make the lives of library staff as well as users easier.

To utilize the digital facilities, Chatkap (2018) reported that both librarians and users are using the digital devices like desktop and laptop computers, mobile phones, tablets, e-readers, flash drives, scanners, printers, speakers etc in the library. Similar results also reported by Cummings, Merrill and Borrelli (2010) which are58.4 percent of respondent library users who own a

web-enabled handheld device would prefer to use small screen devices, such as PDAs or web-enabled smartphones to search a library OPAC and Green and Huang (2013) found that using smartphones in library services are satisfactory as this device is a combination of capabilities of a mobile phone, a personal digital assistant, a web browser, a portable device player, a digital camera, and a GPS navigation unit.

Although the adoption of digital technologies in library management has incorporated ample of benefits for librarians and users but Kumar (2009) identified its impact that some services in the academic libraries such as the open information culture has shifted focus from subject experts and limited modes to common man's participative domain where inputs can be simultaneously added and accessed and new modes of wikis, blogs, Web 2.0, information commons, instant messaging are integrated in library facilities and services. In a study, Onuoha and Obialor (2015) also reported that the digital technology has changed the format of contents and method of production, and the role of librarians from intermediary to facilitators. These new tools for dissemination of information have shifted the library services from physical to virtual environment, extinct some conventional library services and emerged new and innovational web based library facilities.

Though digital devices are effective and efficient in library operations and services but there is prevailing many challenges to adopt and use these devices in the libraries. Agyen-Gyasi, Lamptey and Frimpong (2010); Islam and Islam (2007); Roknuzzaman and Rashid (2016) and Khan and Hossain (2016) identified the challenges of adopting digital devices such as lack of necessary ICT skills to both users and information providers, limited infrastructures, increased costs of digital materials and tools and lack of skills to apply digital devices in the library operations and services. Along with these, Islam and Islam (2007); Roknuzzaman and Rashid (2016) and Khan and Hossain (2016) also identified the challenges in Bangladesh such as- lack of sharing initiative, inadequate financial support, absent of standardization and unawareness about e-resources, pessimistic approaches of the authorities about IT equipments and training and absent of policy of using digital technology. Whereas, Chatkap (2018) reported that non-tech savvy users could not utilize the digital facilities and services properly without digital literacy training.

They should be trained to gain the maximum benefits from digital facilities in the libraries, while Mwageni (2019) said these challenges in one way or another hinder application of digital devices and utilization of digital facilities, resources and services as well.

The adoption of digital technologies in libraries of Bangladesh were started in 1980s, although the computer was first introduced in the Bangladesh Atomic Energy Commission at Dhaka in 1964 (Rahman, 2020). In a study Khan and Uddin (2006) reported that ICDDR,B Library first introduced the computerized library system in Bangladesh using the Inmagic software in 1987. After a decade, Ahmed (1998) found in a survey that 58 libraries were using computers for their operations and services and Rahman (1999) revealed that there were using micro computers, dot-matrix and laser printers, scanners, floppy disks and CD-ROMs in library operations and services. He also reported that there was no computer network among libraries in Bangladesh till 1997. Whereas Chandel and Begum (1998); Rahman (1999) mentioned that BANSDOC launched the first computer network to connect 15 university and research institution libraries in the country, named Bangladesh National Scientific and Library Information Network (BANSLINK) via dial-up connections under the Automation and Networking of Science and Technology Libraries in Bangladesh project in 1998. In a study on users' behavior, Khan and Hossain (2016) found that the web based library services have changed users' expectations such as - the users want seamless access to information on a single point, discover non-textual resources such as images and data, be able personalized their information services on the web, and be available on demand without processing delays. The libraries are working on these to meet the users' expectations such as Sanaullah and Uddin (2020) found, the users comfortable and friendly to use digital resources and the most popular open source software such as Koha-ILS and Dspace are highly involved in integrated library management system in Bangladesh.

Then Adamou and Ntoka (2017) studied on users' perception on digital culture and found that the general perception of both library users and librarians towards digital material and e-resources and services are satisfactory, they are also satisfied with the convenience of digital material and the availability of e-resources provided by academic libraries and Smith (2017)

reviewed the policies of using digital devices in libraries and recommended for reflecting the digital devices policy on the areas of digital access, managing digital access, respecting copyright, conditions of access to library computers and digital equipments, conditions of use for portable digital devices, storage, disclaimer etc.

From the above review, it can be concluded that the adoption of digital devices could enhance the convenience of library operations, facilities and services although a lot of challenges are there. Given that this literature review has discussed the reasons, impact, benefits and effectiveness along with challenges of adopting digital devices which complement the researcher to understand the range of the present study.

Data Analysis and Interpretation

The collected data from five public and eight private university libraries in Dhaka city through a structured questionnaire were duly verified for accuracy and analyzed it by using the statistical methods. The results of the analysis of data on the adoption of digital devices, access to e-books and e-journals, digital facilities in the university libraries are presented in the tabular form below.

1. Adoption of Digital Devices

Table-1 shows that all 13 (100%) respondent university libraries are using desktop computer, flash drive, flatbed scanner and printer. On which the highest number of 110 desktop computers and 15 printers is used by DU library, 20 flash drives is employed in DU and EWU libraries, and 5 flatbed scanners is with BUET and DU libraries.

On the other hand, 12 (92.31%) university libraries are using server, out of which the highest number of 7 servers is applied by DU library and JU library does not have any server as it is not automated till now. 11 (84.62%) university libraries are utilizing portable hard disk drive, where the highest number of 6 portable hard disk drives is used by DIU and EWU libraries and none of it is used in AUST and JU libraries, and 10 (76.92%) university libraries are using laptop computer, on which JU library utilizes the largest number of 70 laptop computers and AUST, BUFT and EU libraries do not use laptop computer.

Table-1: Adoption of Digital Devices

Name of Digital Device	AIUBL	AUSTL	BRACUL	BSMMUL	BUETL	BUFTL	DIUL	DUL	EULL	EWUL	IUBL	JUL	SBAUL	Total Univ.	Percentage %
Desktop Computer	7	3	42	66	75	35	21	110	12	41	95	20	15	13	100%
Digital Camera	Nil	Nil	Nil	1	1	Nil	Nil	Nil	Nil	1	Nil	Nil	2	4	30.77%
Flash Drive (Pen Drive)	4	2	2	6	3	6	2	20	2	20	2	2	10	13	100%
Flatbed Scanner	1	1	2	3	5	2	2	5	2	4	1	1	3	13	100%
Handheld Scanner	2	Nil	4	1	1	4	2	Nil	2	2	Nil	Nil	2	9	69.23%
Headphone	2	Nil	13	5	Nil	5	10	Nil	1	15	2	Nil	1	9	69.23%
Laptop Computer	2	Nil	1	2	3	Nil	5	2	Nil	2	3	70	1	10	76.92%
Multimedia Projector	Nil	Nil	Nil	Nil	1	Nil	1	Nil	Nil	1	1	Nil	1	5	38.46%
Portable Hard Disk Drive	1	Nil	5	1	2	1	6	2	1	6	1	Nil	2	11	84.62%
Printer	3	2	5	6	12	3	3	15	1	6	3	4	3	13	100%
Server	1	1	5	1	3	2	5	7	2	3	2	Nil	5	12	92.31%
Smart Card	Yes	Nil	Yes	Yes	Yes	Nil	Nil	Yes	Nil	Nil	Nil	Nil	Yes	6	46.15%
Speaker	Nil	3	2	Nil	Nil	Nil	3	Nil	Nil	2	Nil	30	2	6	46.15%
e-Reader, Tablet, Notebook, Notepad, iPad, PDA and Others	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	0	00%
Total Digital Devices	10	6	11	11	11	8	11	8	8	12	9	6	13		

AIUBL: American International University of Bangladesh Library; AUSTL: Ahsanullah University of Science and Technology Library; BRACUL: BRAC University Library; BUETL: Bangladesh University of Engineering and Technology Library; BUFTL: BGMEA University of Fashion and Technology Library; BSMMUL: Bangabandhu Sheikh Mujib Medical University Library; DIUL: Daffodil International University Library; DUL: University of Dhaka Library; EUL: Eastern University Library; EWUL: East West University Library; IUBL: Independent University, Bangladesh Library; JUL: Jagannath University Library; SBAUL: Sher-e-Bangla Agricultural University Library.

Then, 9(69.23%) university libraries are employing handheld scanners and headphones, however, BRACU and BUFT libraries utilize the maximum number of 4 handheld scanners and none of it is used by AUST, DU, IUB and JU libraries. Regarding headphones, the highest number of 15 headphones is used by EWU library and none of it is used by AUST, BUET, DU and JU libraries. Again, 6 (46.15%) libraries utilize smart cards and speakers on which JU library uses the largest number of 30 speakers and none of it is utilized by 7 (53.84%) libraries such as AIUB, BSMMU, BUET, BUFT, DU, EU and IUB libraries. Then, 5(38.46%) libraries, namely, BUET, DIU, EWU, IUB and SBAU libraries each uses one multimedia projector and none of this device is used by 8(61.54%) other respondent libraries. But 4(30.77%) libraries employ digital camera where the highest number of 2 digital cameras is employed by SBAU library and none of it is belong to other libraries except BSMMU, BUET and EWU libraries. Then again, 11 (84.62%) of the respondent university libraries such as AIUB, BRACU, BSMMU, BUET, BUFT, DU, DIU, EU, EWU, IUB and SBAU libraries are adapted with 8 to 13 items of digital devices for their operations and services where 2 (15.38%) libraries, namely AUST and JU libraries are utilized between 6 to 7 items. Some popular digital devices such as e-readers, tablets, notebooks, notepads, iPod, PDA and others are not used in the university libraries in Bangladesh.

2. Access to e-Books Databases

Table-2 shows that 13 e-books databases such as Cambridge University Press, McGraw-Hill, Oxford University Press, Pearson Education, Project MUSE, SAGE, Science Direct e-books, Springer, Taylor & Francis, Wiley Online Library, World Scientific, Manupatra and TEEAL are subscribed by 12

Table-2: Access to e-Books Databases

Name of the Database	AIUBL	AUSTL	BRACUL	BSMMUL	BUETL	BUFTL	DIUL	DUL	EUL	EWUL	IUBL	JUL	SBAUL	Total Uni.	Percentage %
Cambridge University Press	Yes	Yes	Yes	Nil	Yes	Nil	Yes	Yes	Nil	Yes	Nil	Yes	Nil	8	61.54%
McGraw-Hill	Yes	Yes	Yes	Nil	Yes	Nil	Nil	Yes	Nil	Nil	Nil	Yes	Nil	6	46.15%
Oxford University Press	Yes	Yes	Yes	Nil	Yes	Yes	Nil	Yes	Yes	Yes	Nil	Yes	Yes	10	76.92%
Pearson Education	Nil	Yes	Yes	Nil	Yes	Nil	Nil	Yes	Nil	Nil	Nil	Yes	Yes	6	46.15%
Project Muse	Nil	Nil	Yes	Nil	Nil	Nil	Nil	Yes	Yes	Yes	Nil	Nil	Nil	4	30.77%
SAGE Knowledge	Yes	Yes	Yes	Nil	Yes	Nil	Nil	Yes	Nil	Nil	Nil	Yes	Nil	6	46.15%
Science Direct e-Books	Nil	Nil	Yes	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	1	7.69%
Springer	Nil	Yes	Yes	Nil	Yes	Nil	Yes	Yes	Nil	Yes	Yes	Yes	Nil	8	61.54%
Taylor & Francis	Nil	Nil	Nil	Nil	Yes	Nil	Nil	Yes	Yes	Nil	Nil	Yes	Nil	4	30.77%
TEEAL	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Yes	Nil	Nil	Nil	Nil	Yes	2	15.38%
Wiley Online Library	Yes	Yes	Nil	Nil	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Nil	Yes	10	76.92%
World Scientific	Nil	Nil	Nil	Nil	Yes	Yes	Yes	Yes	Nil	Nil	Nil	Nil	Nil	4	38.46%
Manupatra	Nil	Nil	Yes	Nil	Nil	Nil	Nil	Nil	Nil	Yes	Nil	Nil	Nil	2	15.38%
Number of Titles of e-Books	60,000	22,100	44,042	0	1200	3500	29,530	35,000	25,000	113,256	25,000	24,000	8000		
16 e-Books Databases	***Access as membership benefits of Bangladesh INASP-PERI Consortia (BIPC) and least developing country:*** AGRIS, Annual Reviews, Bentham Open, Canadian Science Publishing, Cochrane Library, Edinburgh University Press, Mary Ann Liebert, Policy Press, RePEc, SPIE Digital Library, The Royal Society, DE GRUYTER, LIS Books Collection, Research4Life, IMF eLibrary and UN Data Portal.													13	100%

respondent university libraries in Dhaka city through perpetual or yearly subscription models. BSMMU library does not have subscription to any e-books database. In addition to the above, the university libraries have access to 16 e-books databases such as AGRIS, Annual Reviews, Bentham Open, Canadian Science Publishing, Cochrane Library, Edinburgh University Press, Mary Ann Liebert, Policy Press, RePEc, SPIE Digital Library, The Royal Society, DE GRUYTER, LIS Books Collection as the member of Bangladesh INASP-PERI Consortia (BIPC) and also have free access to Research4Life, IMF eLibrary and UN Data Portal as a least developing country.

Out of 13 respondent university libraries, the highest number of 10 (76.92%) libraries subscribes Wiley Online Library and Oxford University Press and the second highest number of 8 (61.54%) libraries have subscription to Cambridge University Press and Springer, followed by 6 (46.15%) libraries subscribe McGaw-Hill, Pearson Education and SAGE Knowledge, 4 (30.77%) libraries have subscription to Project Muse, Taylor & Francis and World Scientific, 2 (15.38%) libraries subscribe Manupatra and TEEAL and only 1(7.69%) library subscribes Science Direct e-books database.

Table-2 also shows that EWU library is the subscriber of the largest number of 113,256 titles of e-books and the second largest subscriber with 60,000 titles of e-books is AIUB library, followed by BRACU library with 44,042 e-books, DU library with 35,000 e-books and DIU library with 29.530 e-books. After that, EU and IUB libraries each are the subscribers of 25,000 titles of e-books, JU library has access to 24,000 e-books and AUST library subscribes 22,100 e-books. Whereas, SBAU library is the subscriber of 8000 titles of e-books, BUFT library has subscription to 3500 e-books and BUET library subscribes 1200 e-books through perpetual or yearly subscription models.

3. Access to e-Journals Databases

Table-3 shows that 18 e-journals databases such as ACM Digital Library, Cambridge University Press, IEEE Explore, EBSCO Host, Emerald Insight, Jstor, Oxford University Press, Project MUSE, Scopus, SAGE Knowledge, Springer, Taylor & Francis, Wiley Online Library, World Scientific, ABI Global, Market Line, SDC and WGSN are subscribed by 12 respondent university libraries in Dhaka city through yearly subscription model. BSMMU library does not have subscription to any e-journals database for this year.

Table-3: Access to e-Journals Databases

Name of the Database	AIUBL	AUSTL	BRACUL	BSMMUL	BUETL	BUFTL	DIUL	DUL	EUL	EWUL	IUBL	JUL	SBAUL	Total Uni.	Percentage %
ACM Digital Library	Yes	Yes	Nil	Nil	Yes	Nil	Nil	Yes	Yes	Yes	Yes	Yes	Nil	8	61.54%
Cambridge University Press	Yes	Yes	Yes	Nil	Yes	Yes	Nil	Yes	Yes	Yes	Yes	Nil	Nil	9	69.23%
IEEE Explore	Yes	Yes	Nil	Nil	Yes	Nil	Yes	Yes	Yes	Yes	Yes	Yes	Nil	9	69.23%
EBSCO Host	Nil	Nil	Yes	Nil	Yes	Nil	Nil	Yes	Nil	Nil	Nil	Nil	Nil	3	23.08%
Emerald Insight	Yes	Yes	Yes	Nil	Yes	Nil	Nil	Yes	Nil	Yes	Yes	Yes	Nil	8	61.54%
Jstor	Yes	Yes	Yes	Nil	Yes	Yes	Nil	Yes	Yes	Yes	Yes	Yes	Yes	11	84.62%
Oxford University Press	Yes	Yes	Yes	Nil	Nil	Nil	Nil	Yes	Yes	Nil	Nil	Nil	Yes	6	46.15%
Project MUSE	Nil	Nil	Yes	Nil	Yes	Nil	Nil	Yes	Nil	Nil	Nil	Nil	Nil	3	23.08%
SAGE Knowledge	Yes	Yes	Nil	Nil	Yes	Nil	Nil	Yes	Nil	Yes	Nil	Nil	Nil	5	38.46%
Springer	Nil	Yes	Yes	Nil	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Nil	Nil	9	69.23%
Taylor & Francis	Yes	Yes	Nil	Nil	Yes	Nil	Yes	Yes	Nil	Nil	Nil	Nil	Yes	6	46.15%
Wiley Online Library	Yes	Yes	Yes	Nil	Yes	Nil	Yes	Yes	Yes	Yes	Yes	Nil	Yes	10	76.92%
World Scientific	Nil	Yes	Nil	Nil	Nil	Nil	Yes	Yes	Nil	Nil	Nil	Nil	Nil	3	23.08%
ABI Global	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Yes	Nil	Nil	1	7.69%
Market Line	Nil	Nil	Yes	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	1	7.69%
SDC	Nil	Nil	Nil	Nil	Nil	Yes	Nil	Nil	Nil	Nil	Nil	Nil	Nil	1	7.69%
Scopus	Nil	Nil	Yes	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	1	7.69%
WGSN	Nil	Nil	Nil	Nil	Nil	Yes	Nil	Nil	Nil	Nil	Nil	Nil	Nil	1	7.69%
Number of Titles of e-Journals	12,000	11,000	45,981	Nil	50,000	4800	3525	22,000	3510	51,412	20,000	44,100	12,110		
30 e-Journals Databases	***Access as membership benefits of Bangladesh INASP-PERI Consortia (BIPC) and least developing country:*** AGRIS, American Institute of Physics (AIP), American Society of Agricultural and Biological Engineers (ASABE) Technical Library, Annual Reviews, American Physical Society (APS), arXiv.org e-Print archive, American Society of Civil Engineers (ASCE), Bangladesh Journals Online (BanglaJol), Bentham Open, BioMed Central, British Institute of Radiology (BIR), Canadian Science Publishing, Cochrane Library, Edinburgh University Press, Geological Society, Indian Open Access Journals, International Forestry Review, IOP Publishing, Mary Ann Liebert, Optical Society of America, PubMed Central (PMC), PNAS, Policy Press, RePEc, Royal College of Physicians, SPIE Digital Library, The Royal Society, IMF eLibrary, Research4Life and UN Data Portal.													13	100%

In addition to the above, the university libraries have access to 30 e-journals databases, namely, AGRIS, American Institute of Physics (AIP), American Society of Agricultural and Biological Engineers (ASABE) Technical Library, Annual Reviews, American Physical Society (APS), arXiv.org e-Print archive, American Society of Civil Engineers (ASCE), Bangladesh Journals Online (BanglaJol), Bentham Open, BioMed Central, British Institute of Radiology (BIR), Canadian Science Publishing, Cochrane Library, Edinburgh University Press, Geological Society, Indian Open Access Journals, International Forestry Review, IOP Publishing, Mary Ann Liebert, Optical Society of America, PubMed Central (PMC), PNAS, Policy Press, RePEc, Royal College of Physicians, SPIE Digital Library and The Royal Society databases as the member of Bangladesh INASP-PERI Consortia (BIPC) and also have free access to IMF eLibrary, Research4Life and UN Data Portal as a least developing country.

Out of 13 respondent university libraries, the highest number of 11 (84.62%) libraries subscribe Jstor and the second highest number of 10 (76.92%) libraries subscribe Wiley Online Library, followed by 9 (69.23%) libraries have subscription to Cambridge University Press, IEEE Explore and Springer and 8 (61.54%) libraries have access to ACM Digital Library and Emerald Insight. Then, 6 (46.15%) libraries subscribe Oxford University Press and Taylor & Francis, 5 (38.46%) libraries have subscription to SAGE knowledge, 3 (23.08%) libraries subscribe EBSCO Host, Project MUSE and World Scientific, and only 1 (7.69%) library subscribes ABI Global, Market Line, Scopus, SDC and WGSN e-journal databases through yearly subscription model for this year.

On the other hand, EWU library subscribes the largest number of 51,412 titles of e-journals and the second largest number of 50,000 titles of e-journals is subscribed by BUET library, followed by BRACU library with 45,981 e-journals, JU library with 44,100 e-journals and DU library subscribes 22,000 e-journals, and IUB library has subscription to 20,000 e-journals. After that, SBAU library subscribes 12,110 titles of e-journals, AIUB library is the subscriber of 12,000 e-journals, AUST library subscribes 11,000 e-journals and BUFT library has subscription to 4800 e-journals. Then again, DIU library subscribes 3525 titles of e-journals and EU library is the subscriber of 3510 e-journals for this year.

4. Digital Facility and Institutional Repository

Table-4 shows that all 13 (100%) respondent university libraries have Wi-Fi and broad band Internet correction and digital facilities. On an average, the largest number of 1000 users utilizes the digital facilities of EWU library every day and the second largest number of 500 users utilizes the digital facilities of DU library per day, followed by BUFT library with 400 users, DIU library with 250 users, AUIB library with 200 users, IUB library with 150 users, and 100 users each utilize the digital facilities of AUST, EU and SBAU libraries every day. The users of digital facilities of BSMMU library are 60 only while JU library has 30 users per day and BRACU and BUET libraries have no statistics on it.

Regarding automation, 8 (61.54%) respondent libraries, namely BUFT, BUET, DIU, DU, EU, EWU, IUB and SBAU libraries are using open source software Koha- Integrated Library System (Koha-ILS), whereas 3 (23.08%) libraries, namely AIUB, AUST and DU libraries are utilizing their customized software AIUB University Management System (AIUB-UMS), AUST Integrated University Management System (AUST-IUMS) and DU Library and Information System (DULIS) respectively. 1 (7.69%) library such as BSMMU library has installed open source software Sanyan Library Management System (SLiMS) for automation and 1 (7.69%) library, namely IUB library utilizes MS-Access software along with Koha-ILS. Whereas, 1(7.69%) library, i.e. JU library is operating manually till now.

This study found that 9 (69.23%) respondent university libraries, namely BRACU, BUET, BUFT, DIU, DU, EU, EWU, IUB and SBAU libraries have installed open source software DSpace for developing Institutional Repository (IR), whereas only BSMMU library is using open source software SLiMS and EWU library is using both DSpace and Green Stone DL (GSDL) software for their IR. But 3 (23.08%) respondent libraries such as AIUB, AUST and JU libraries have not installed IR software yet.

*AUIB-UMS: AUIB University Management System; *AUST-IUMS: AUST Integrated University Management System; *DULIS: DU Library and Information System; *GSDL: Green Stone Digital Library; *Kaha-ILS: Koha-Integrated Library System; *SLiMS: Sanyan Library Management System.

Table-4: Digital Facility and Institutional Repository

Name of the University	Average Users of Digital Facilities Per Day	Automation Software	Digitization Software	Collection of Institutional Repository	Digital Literacy Training Per Year	Installed RFID System	Mode of Internet Connection
AIUBL	200	AUIB-UMS*	Nil	Nil	Nil	Yes	Broad band, Wifi
AUSTL	100	AUST-IUMS*	Nil	Nil	Occasionally	Nil	Broad band, Wifi
BRACUL	N/A	Koha-ILS*	DSpace	13307	50	Yes	Broad band, Wifi
BSMMUL	60	SLiMS*	SLiMS	7,000	12	Yes	Broad band, Wifi
BUETL	N/A	Koha-ILS	DSpace	5,135	2	Yes	Broad band, Wifi
BUFTL	400	Koha-ILS	DSpace	Nil	Nil	Nil	Broad band, Wifi
DIUL	250	Koha-ILS	DSpace	25,000	2	Yes	Broad band, WiFi
DUL	500	DULIS*, Koha-ILS	DSpace	1320	1	Yes	Broad band, Wifi
EUL	100	Koha-ILS	DSpace	Nil	3	Nil	Broad band, Wifi
EWUL	1000	Koha-ILS	DSpace & GSDL*	2,540	96	Nil	Broad band, Wifi
IUBL	150	Koha-ILS, MS Access	DSpace	500	75	Nil	Broad band, Wifi
JUL	30	Nil	Nil	Nil	Nil	Nil	Broad band, Wifi
SBAUL	100	Koha-ILS	DSpace	2,750	150	Yes	Broad band, Wifi

The largest IR with 25,000 resources is in DIU library and the second largest IR with 13307 items is in BRACU library, followed by BSMMU library with 7000 items, BUET library with 5135 items, and SBAU library with 2750 items. The EWU library has IR with 2540 items, IR with 1320 items is in DU library where IUB library has 500 items in its IR. All other 5 (38.46%) respondent university libraries have not started developing IR yet.

SBAU library organizes the largest number of 150 digital literacy trainings every year and EWU library conducts the second largest number of 96 trainings a year, followed by IUB library with 75 trainings, BRACU library with 50 trainings and BSMMU library offers user training for 12 times per year. Then, AUST, BUET, DIU, DU and EU libraries each arrange training for less than 3 times a year. But 3 (23.38%) libraries, namely, AUIB, BUFT and JU libraries never offer such training for their users.

Table-4 also shows that, out of 13 respondent university libraries, 7 (53.85%) respondents namely, AIUB, BRACU, BSMMU, BUET, DIU, DU and SBAU libraries have installed RFID technology in library management system.

Discussions on Results

The above data analysis results indicate that the respondent university libraries are utilizing digital devices in its operations and services and also providing access to e-resources through internet enable facilities. Whereas these are inadequate for effective library operations and there are quite essential to impose more Internet enables digital devices and facilities in the libraries for widening its services beyond the boundaries.

Digital Devices

Although this study found that over one dozen items of digital devices specially computers and its input, output and storage devices are adopted by university libraries in operations and services, whereas the numbers of these digital tools are not enough to provide efficient and effective library services. For instance, two respondent libraries have 3 and 7 desktop computers, 6 libraries each have only 2 flash drives, 7 libraries possess 1 to 2 hand held scanners and 4 libraries have no hand held scanners, 8 libraries have 1 to 2

flatbed scanners and the numbers of other items like printers, servers, laptops, multimedia projectors, speakers etc. are ranging from nil to a few which perhaps used by the library staffs only. But the libraries should have dedicated some digital devices for users so that they can utilize the digital facilities and services. However, the positive sign is that all respondent university libraries have internet connection, while there are missing internet enables digital devices such as e-readers, tablets, notebooks, notepads, iPod, PDA and other devices in the university libraries till now. These popular digital devices should introduce in the university libraries along with existing devices like desktop and laptop computers, servers, flash drives, portable hard drives, printers, headphones, handheld and flatbed scanners etc. to meet the expectations of users.

e-Books Databases:

The strategies of collection development of the libraries have been changed due to new trend of publishing books in both printed and digital form. Currently the respondent libraries are procuring both printed books and e-books for developing their collections. This study reported that the major sources of subscribing e-books databases in the respondent university libraries of Bangladesh areUniversity Digital Library (UDL) Consortia and Bangladesh INASP-PERI Consortia (BIPC) and the most of e-books packages are subscribed by using perpetual subscription model through UDL. Besides these, the academic libraries in Bangladesh also have free access to e-books databases as a least developing country and the membership benefits of BIPC.

About the e-books collection, the number of databases, book titles and diversification of the subject field of e-books are very limited. The study found that the most of the respondent university libraries subscribe e-books in science, social sciences and humanities from Wiley Online Library (76.92%), Oxford University Press (76.92%), Springer (61.54%) and Cambridge University Press (61.54%). The total number of subscribed e-books titles are ranging from nil to 50 thousands whereas the above half (53.85%) of respondent libraries subscribe below 25 thousand titles of e-books. These poor subscriptions of e-books may be due to free access to research4life databases from academic institutions in Bangladesh and less expectations of users

regarding e-books from university libraries due to unfamiliar with the benefits of e-resources. There are no e-books databases on physical sciences, bio-medical sciences, agriculture and engineering in the subscription list of the respondent university libraries so that those e-books databases and other e-books should procure along with existing 29 e-books databases in the university libraries of Bangladesh.

e-Journals Databases

With the rapid growth of e-journals and disappeared of printed journals from the markets, the university libraries in Bangladesh were started subscription to e-journals databases by individual institutional subscription but after the formation of consortia, namely University Digital Library (UDL) Consortia and Bangladesh INASP-PERI Consortia (BIPC), they are subscribing the most of e-journals through these consortia. In addition to these, the respondent libraries are having free access to a good number of e-journals databases as a least developing country and the membership benefits of BIPC.

From the above data analysis, it is found that the highest numbers of respondent university libraries subscribe e-journals in science, social sciences and humanities from Jstor (84.62%), Wiley Online Library (76.92%), Springer (69.23%)and Cambridge University Press (69.23%). Regarding engineering and business, the second highest numbers of respondent university libraries subscribe e-journals databases of IEEE Explore (69.23%), ACM Digital Library (61.54%) and Emerald Insight (61.54%) as the universities especially private universities in Bangladesh are offering the degrees in computer science and business. Among the subscribed e-journals, the nearly half (46.15%) of the respondent university libraries subscribe the total e-journals titles ranging from 3.5 to 12 thousands only. There is no e-journals databases subscription in physical sciences, bio-medical sciences and agriculture in the respondent university libraries. The reason of this may be because of complementary access to research4life databases from academic institutions in Bangladesh. However, the university libraries should subscribe physical sciences, bio-medical sciences, agriculture, engineering and other e-journals databases along with existing 48 e-journals databases in the university libraries of Bangladesh to meet the expectations of users.

Digital Facility and Institutional Repository

This study reported that all respondent university libraries have Wi-Fi and broad band internet connection and provide digital technology based library facilities and services. The usage of digital facilities is quite good as 81.81% respondent libraries have reported that the numbers of users are ranging from 100 to 1000 per day, although two respondent libraries could not provide the numbers of users due to shutdown of the libraries during COVID 19.

Automation of libraries in Bangladesh was started in 1990s with the customized software whereas this study found that 61.54% respondent university libraries are using open source software Koha-ILS now. Similarly, 69.23% respondent university libraries have installed open source software DSpace for developing Institutional Repository (IR), and 61.54% respondent libraries have already added 500 to 25,000 items in their IR databases. Besides these, some others open source software like SLiMS and Green Stone Digital Library (GSDL) are also adopting in the university libraries of Bangladesh. These findings indicate that the university libraries in Bangladesh are moving toward open source era. The trends of installation of the latest digital technology are also encouraging as this study found that above half (53.85%) of the respondent university libraries have installed RFID technology for automation of the libraries.

Without digital literacy, it is not possible to properly utilize digital facilities and services. So there is required digital literacy training in the libraries for users. This study found that 76.92% respondent university libraries offer digital literacy training for users ranging from occasionally to 150 times per year. The library authority should encourage and send the library staff to attend IT training so that they can conduct digital literacy training effectively.

From above discussion, it is indicated that the respondent university libraries are moving forward to digital technology based library systems and services by using digital devices, subscribing e-resources, installing open source software and developing local digital contents. They are also undertaking digital literacy programs for users to build awareness about benefits of digital devices and e-resources and also utilization of them properly.

Implications

Adoption of digital devices has changed the ways of library operations and extended the services from a physical building to virtual world. It has eliminated the barrier of space and time of users and facilitated access to require resources in real time. So that, the libraries in Bangladesh are adopting digital devices in operations and services and subscribing online e-resources for expanding services beyond the location and time, whereas this study has found some more prospects and a few limitations of utilizing digital facilities and services among the university libraries in Bangladesh. Now it is required to take some measures to overcome these limitations and materialize the prospects. In this regard, the government, university authority, LIS professional associations and academic institutions should come forward to implement the following recommendations to enhance the digital facilities and services and eliminates the barriers of digital culture in the university libraries of Bangladesh.

1. The university libraries should adopt more digital devices like e-readers, tablets, notebooks, notepads, iPod, PDA along with existing digital devices using in the libraries of Bangladesh and install RFID technology for managing the library facilities efficiently and executing the operations and services of the libraries effectively. For this, the university libraries should develop adequate infrastructure for establishing digital learning environment and instigate to cultivate digital culture in the campus.
2. The authority should extend all supports to the university library for automation and also develop an Institutional Repository (IR) for scholarly activities of the university.
3. The university authority should be generous to the library staffs for attending ICT trainings in home and abroad.
4. The university authority should allocate enough library budgets and help to procure necessary digital devices, facilities such as EZproxy, Shibboleth, plagiarism software etc. and subscribe access to adequate e-resources.
5. As digital literacy training for users is required to gain maximum benefits of adoption of digital devices and e-resources in the library so enough digital literacy training should be offered by the university libraries in a year.

6. The subscription model of e-books and e-journals should be modified and go for national licensing subscription model instead of the number of access points.
7. The academic departments of library and information science in Bangladesh should modify ICT courses in their curriculum in every two years and extend hand-on training on digital technologies for their graduates.
8. The LIS professional associations of Bangladesh should organize more short training on ICT and the Government should allocate enough funds for refresher trainings so that the working library staffs can attend these trainings to update them.
9. The government should make internet charge free for the educational institutions and the university authority should provide library facilities and services free of charge.
10. The university libraries should adopt internet enable digital devices such as MP3 players, gaming devices, interactive whiteboards, digital TVs, podcasts, vodcasts, peer-to-peer networking, content syndication, blogs and moblogs, photoblogs, wikis, tag clouds and voice over IP.It should also need to introduce digital tools of e-learning and content management systems, web conferencing, slide sharing, report cards, e-portfolios, virtual rooms, plagiarism detection, virtual worlds and online collaborative work spaces. In addition to these, the adoption of open content, social networking, collaboration and sharing, mobile technologies and new scholarship (White, 2008) facilities are essential in the university libraries of Bangladesh.
11. There is required a national digital information network among the libraries in Bangladesh for sharing resources and also needed a national digital policy and standard on the areas of digital contents, respecting copyright, managing and utilizing digital devices, conditions of use for portable digital equipments, storage, disclaimer etc. The LIS professional associations should come forward to instigate the government for taking initiative to establish a digital network and enact the policy and standard of digital tools.

Given above the implications of findings of this study would extend the digital culture among the university libraries in Bangladesh. They would be competent enough in terms of digital facilities, services and access to adequate e-resources that help to meet the users' expectations, and also be able to extend their services beyond the boundaries without limitations of location and time of users.

Conclusion

The pattern of library operations, services and interaction with users have been changed due to adoption of digital devices. These high-tech devices have widened the scope and facilities of the university libraries and also have increased the efficiency of operations and effectiveness of services. These devices have ability to store massive amount of resources permanently in a tiny space, retrieve them quickly and access to them from anywhere at any time. With introduction to internet, the information communication, storage and retrieval in the libraries have turn into more dependent on digital tools and internet enable library facilities and services have made easy access to e-resources remotely. Users are familiar with internet enable library facilities and services, that's why the university libraries have adopted online e-resources databases consist of thousands of e-books and e-journals and developing local digital contents like institutional repository along with open resources, social networking, plagiarism detection and mobile technology to meet the requirements of the users. This study reported that total thirteen types of digital devices are using in the respondent university libraries in Bangladesh,two-third of them have already been installed open source software such as Koha-ILS, SLiMS, DSpace and GSDL for automation and digitization and they are developing IR with thousands of local contents. To get maximum benefits of these digital facilities and resources, the university libraries are organizing digital literacy trainings for users so that they can operate and utilize the digital facilities and services in proper ways. However, the university libraries should include more digital devices and facilities to enrich the interactive library services and widen it beyond the physical boundaries, otherwise the users of the university libraries in Bangladesh would not able to cope up with the development of world literature.

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Appendix

Questionnaire

Using Digital Devices and e-Resources in University Libraries of Bangladesh

1. Name of the Institution:

2. Address of the Institution:

3. Year of Establishment:

4. Category of the Institution: (Please cross (x) mark on an appropriate answer)

Agriculture		Engineering/Science & Technology	
General University		Medical Sciences	

5. Do you use the digital devices in the library management? (Please cross (x) mark on an appropriate answer)

Yes		No	

If yes, please write the number of devices that you use in the library.

Name of the Devices	Number of Devices	Name of the Devices	Number of Devices
Desktop Computer		Server (Computer)	
Laptop Computer		Portable Hard Disk Drive	
Tablet Computer		Scanner	
Smartphone		Printer	
Notebook		Camera	
Notepad		Headphone	
Portable E-Reader		Speaker	
PDA (Personal Digital Assistance)		Hand Held Scanner :	
Flash Drive (Pen Drive)		Others (Please specify):	

6. Give the name of the databases of e-books with source and subscription model which have access from your library.
(Please write source, model and cross (x) mark on an appropriate answer)

Cambridge University Press		Springer	
McGraw-Hill		Wiley	
Oxford University Press		World Scientific	
Pearson Education		Research4Life	
SAGE		Others (please specify):	

7. Please write of the name of databases of e-journals with source and subscription model which have access from your library. (Please write source, model and cross (x) mark on an appropriate answer)

ACM Digital Library		Research4Life	
Cambridge University Press		SAGE Knowledge	
IEEE Explore		Springer	
Emerald Insight		Taylor & Francis	
Jstor		Wiley Online Library	
Oxford University Press		World Scientific	
Pearson Education		Others (please specify):	

8. How many users physically visit your library on an average every day?

9. How many users use the digital resources of your library on an average every day?

10. Do you have digital repository in the library? (Please cross (x) mark on an appropriate answer)

Yes		No	

If yes, please give the total numbers of titles of collection in the digital repository?

11. Do you arrange digital literacy training for users in the library? (Please cross (x) mark on an appropriate answer)

Yes		No	

If yes, how many times are you arrange digital literacy training for library users on an average every year?

12. Write the name of Library Automation and Digitization software that are using in your library.

(a) Automation Software:

(b) Digitization Software:

13. What type of Internet connection is using in your library? (Please cross (x) mark on an appropriate answer)

Board Band		WiFi		Broad Band and WiFi	

14. Pease give the total number of collection in the library:

(a) Total Number of Printed Books:

(b) Total Number of Online Books:

(c) Total Number of Current Subscription of e-Books:

(d) Total Number of CD/DVDs:

(e) Total Number of Video (VHS):

(f) Total Number of Audio cassettes:

(g) Others (please specify):

15. Please give the total number of titles of journals subscribed in this year:

(a) Total Number of Titles of Current Subscription of Printed Journals:

(b) Total Number of Titles of Current Subscription of Online Journals:

(c) Total Number of Titles of Subscription of other digital resources (if any please specify):

16. Please cross (x) mark on an appropriate answer, if you have RFID equipments in the library, otherwise skip this section.

Name of the equipments	Cross(x)	Name of the equipments	Cross(x)
RFID Tag		RFID Level printer with conversion station	
Self Check Machine / Kiosk		RFID Smart card system with printer/convertor	
Anti Theft Detection EAS Gate		Hand Held Reader	
Staff work station/ Circulation station		Conveyer/ Sorter system	
Book Drop Station		RFID Level printer with conversion station	
Conversion Station/Machine		Access Control Gate (Duel/single) With SS Fence	
Shelf Manager or DLA		RFID Card (ID card)	
Others (please specify):			

17. Write your future plan of procuring the digital devices for your library.

Name:

Designation:

Date:

Research Trends of ICT and Bangladesh: A Bibliometric Approach

Md. Armanul Haque *
Xiaojuan Zhang **

The paper aims to demonstrate the bibliometric analysis of the documents on ICT and Bangladesh published in the Scopus database. Through a basic search in Title, abstract, and keyword, a total of 337 documents were extracted and through title search a total of 59 has been consided for the final analysis. In 2020, paper publishing reach its pinnacle. VOSviewer and Microsoft Excel were used to analyze the extracted documents. The study has shown the most influential author in terms of document and citation, institutions/organizations, influential countries in terms of document publication, and highest citation received. Both author and all keywords were also presented through tabular and visualization maps. In terms of document publication, Dewan A.M. and Nazmin S.A. are the most influential author.In their single document, Chadni M.H., Ferdaus J., and Murshed M. got high citations. In all keyword co-occurrences and author keywords utilized, Bangladesh was determined to be the most influential nation and most used keywords. Bangladesh was determined to be in first place among 18 nations in terms of document publishing and citations. When compared to the organizational analysis, Dhaka University generated the most documents, and the department of Economics at Cumilla University earned the most citations. The leading source in terms of document publishing is IFIP Advances in Information and Communication Technology, whereas the top rank in terms of citationsin this study is Energy, Ecology and Environment.

Keyword: Research, ICT, Bangladesh, Bibliometric, Scopus

Introduction

Information and Communication Technologies (ICTs) are essential elements for the human worlds' development. I.C.T.s have been taken their role in every phase of growth in the society not only in the developed countries but also in the developing countries. In Bangladesh, the use of technology is becoming more and more popular. Technological advancement would serve as the primary source of economic growth. Digital Bangladesh, the present government,

* Associate Professor, Department of Information Science & Library Management; Faculty of Social Science; University of Rajshahi, Bangladesh & PhD fellow, Wuhan University, China.
** Professor, School of Information Management, Wuhan University, China.

intends by the year 2021 to incorporate ICTs as a pro-poor mechanism for poverty eradication, good governance, quality education, sanitation, and enforcement and brace citizens for global climate change (Karim, 2010). The core drivers contributing to economic development in mature and emerging economies have been science, technology, and innovation. For more than a decade, ICTs have become the heart of the economic transition. The ICT industry plays an important role, in particular by helping to advance technology and increase productivity. In reaction to international competition and to the growing need for strategic interaction, companies use ICTs to coordinate transnational networks. Consequently, international companies are a key vehicle for the ever-expanding globalization process (Ðsmail, 2008).

Now ICT has been a growing research field in the literature. Since numerous scholars are publishing various publications on the ICTs, it is vital to know the research trends of those aspects through a bibliometric approach. As a result, the policymakers and administration of the different countries can know the best-applied method of work. Therefore, bibliometric analysis is one of the significant ways to find the knowledge map easily. The bibliometric study has been one of the essential topics of works in the literature. Numerous publications have been published on this area. In Scopus, 7,737 documents on this area have already been published up to April 6, 2021, where 592 publications in 2021, 1504 in 2020, and 1021 in 2019 (Scopus, 2021). This document demonstrates ICT and Bangladesh research accomplishments that will enable researchers and practitioners to detect the fundamental impacts of authors, journals, countries, institutions, and research topics.

Objectives of the study

The main objective of the study is to carry out a bibliometric analysis of the extracted documents on the ICT and Bangladesh. The more specific goals are:

- To explore the influential author in terms of documents publications and citations
- To identify the most influential institutions/departments/organizations in terms of document publication and citations.
- To find out the influential country in terms of document publications and citations.
- To determine the most dominating keywords and author keywords.

Review of Literature

Bibliometrics is a computational tool for quantitatively analyzing academic papers on a particular subject using mathematical methods (Chen, Dubin and Kim, 2014). It could also assess study accuracy, analyze key research areas, and forecast possible research directions (Yu et al., 2020). Thus, bibliometrics examines the number of publications written on a given topic, the patterns of literature production, the most prolific source titles, the most involved countries, organizations, and authors, and the most quoted articles to research the properties of literature production. It uses quantitative methods to analyze written documents. Bibliometric studies are often used to look at a field's history and structure, the flow of information into the area, the growth of the literature, patterns of collaboration among scientists, journal impacts, and the long-term citation effect of a work (Wenjuan, Xuezhi and Tieqin, 2013; De Bellis, 2009; Garfield, 2006).

Sood (2020) conducted a study on bibliometric monitoring of research performance in ICT-based disaster management literature. Through reviewing Scopus indexed research documents released between 2009 and 2018, this paper provides a decade-long bibliometric study of the ICT-based disaster response domain. The research investigates the numerous bibliometric trends of publication, citation, keyword frequency, and the central bibliometric aspects of the domain's research. This research aids in comprehending the domain's evolution, history, social significance, and influence, as well as providing a forum for determining potential agendas and roadmaps for interested communities and nations.

ICTs play a significant role in the learning process, including the existing resources to build and gain expertise in the network. Hernández et al. (2017) researched the research trends in the study of ICT.-based learning communities.

This study uses bibliometric analysis to look at the current research state concerning ICT-based learning groups. Since the study of ICT applied to teaching and learning models started in the 1990s, the measures obtained have shown consistent progress, with a substantial rise in interest in the topic in 2005 and the highest productivity of publications in 2010 and 2011. China, the

United States, and Taiwan are the countries that have made the most contributions to the study of ICT in learning contexts, and they are at the forefront of research in this field.

Information sharing, confidence-building processes, and networked learning were identified as problems with emergent behavior.

Besides, ICT in education and research, it has been using in the different administrative sections in every corner of the world. Realizing this crucial importance, numerous researches have conducted in different places of the world. In this connection, Alcaide Muñoz et al. (2017) did a bibliometric study on ICT and public administration. The objective of this research was to provide a robust base for future research studies on the subject by analyzing the ICT in public administrations (e-government) in publications as an essential tool for administrative change in newspapers contained in the Scientific Information Institute.. The bibliometric review emphasizes this topic's maturity and the need for rigorous hypotheses and quantitative research studies to be provided by e-government. The scientific and engineering foundation is a fundamental source of expertise for IT's production and application.. It is necessary to provide accurate macro-level statistics of this knowledge base to describe and track worldwide ICT scientific activities efficiently. Tijssen and Van Wijk (1998) conducted a study on the bibliometric analysis on the global science base of ICTs. The findings of such bibliometric research explaining the macro-level properties of this ICT information base are presented in this article. The data was collected from a specially created CWTS ICT database, which offers a global wide range of high-quality international scientific and technical journals that publishes ICT-relevant scientific articles. Compare the three triad areas, the European Union, the U.S.A., and Japan, in cross-country terms, and concentrate on how scientific products and cooperation patterns work in most involved publishing nations.

In Bangladesh, the work on bibliometric studies is only a few. Few researchers worked on bibliometric analysis in the different perspectives of the literature at different times.

Khatun and Ahmed (2011) conducted a study on bibliometric analysis on diarrhoeal disease research in Bangladesh. Based on data obtained from the PubMed, Web of Science, and Scopus databases, quantitative analysis was made to classify the literature development, authorship pattern, collaboration, and journal distribution on diarrhoeal disease research in Bangladesh. To further investigate the characteristics of diarrhoeal literature, well-established bibliometric laws such as Lotka's law and Bradford's law are used. The Bradford-Zipf delivery was used to identify the key papers in Bangladesh for diarrhoeal disease studies. Furthermore, using h-index on Scopus bibliographic info, a comparison was made to ascertain the intensity of diarrhoeal research in Bangladesh. The findings suggested that Bangladesh is raising its diarrhoeal study R&D. In Bangladesh, Lotka's rule and Bradford distribution do not extend to diarrhoeal disease studies. Bangladesh tops the diarrhoeal study impact list in South Asia, according to the h-index count.

Khan et al. (1998) published a bibliometric analysis paper on library and information science in Bangladesh. The report considered the published article between 1966 to 1997.

The study is based on a list of papers compiled to demonstrate the development and scale of the Library and Information Science (LIS) literature in Bangladesh, patterns of circulation, characteristics of contributing journals, language of publishing, authorship patterns, and geographic distribution of the periodicals and found that a total of 308 papers written by 116 library staff that were published in various periodicals, with Bangladesh having the largest number (256, 83.11 percent), followed by India (21, 6.82 percent). Many of these articles were distributed in 37 periodicals from 14 different countries.

Ahmed and Rahman (2008) worked on the paper on nutrition published between 1972-2006. Authors of the article found 636 papers authored by 998 published in the 100 local and foreign journals. Lotka's law and Bradford-Zipf distribution were found suitable. The study found that 1987 onwards were significant in terms of the publication on nutrition.

Miah, Shin and Koike (2008) also worked on the Bangladesh perspective bibliometric analysis. They researched the publications published related to forestry research in Bangladesh. A total of 194 forestry papers were written, with 89, 48, and 57 appearing in the three selected journals. The Journal of Forestry and Environment was discovered to print an average of 11 forestry papers per volume. From 1977 to 1997, there was a steady increase in forestry papers published in Chittagong University Studies Part II: Science. In the same articles, the contributions of various organisations were found to be influential in the journals at 81 percent, 63 percent, and 63 percent, respectively. In all publications and years, a maximum of 5 authors was found in the articles. For the papers, the average number of authors was found to be 2, 3 and 3 respectively.

According to Scopus (2021, April 7), there are only 7 studies conducted while searched in title search by ICT AND bibliometric in Scopus database and 105 documents were found while searched by ICT AND bibliometric by title, abstract and keyword search. However, literature suggested that no works were found on bibliometric studies on ICT and Bangladesh. Therefore, this study aims to carry out bibliometric analysis on the documents on ICT and Bangladesh.

Methodology

In this bibliometric study, all documents related to ICT and Bangladesh indexed in the Scopus were retrieved on April 6, 2021. When we searched the Scopus database through (ICT AND Bangladesh) then 337 documents appeared (Figure 1) from 1999 to 2021. For exploring the documents; Title, abstract and keyword, was considered. All publications were taken into account irrespective of articles, review, conference paper, book chapters, review, notes, etc., up to April 6, 2021. After a filteration, while we searched through “article title” with the same keywords, its is then appeared 59 documents (Figure2). Finally , the research is conducted with these 59 documents as it contained the terms ICT and Bangladesh in the article title. The documents were found between 2006 and 2021. The most productive year is 2020 with 10 publications (Table 1).

Table 1: Year wise publication

Year	No of documents	Year	No of documents
2021	3	2013	5
2020	10	2012	3
2019	4	2011	3
2018	4	2010	3
2017	5	2009	2
2016	3	2008	2
2015	2	2007	2
2014	6	2006	2

Figure 1: Number of retrieved documents (Taken from the Scopus search result-www.scopus.com)

Figure 2: Number of retrieved documents while searching by article title (Taken from the Scopus search result-www.scopus.com)

As a result, 59 documents related to ICT and Bangladesh were retrieved, and various bibliometric aspects of each document were investigated, including top author, document type, top cited documents, document distribution around

the world, the most productive countries, institutions, and journals, and so on. VOSviewer and Microsoft Excel are used to calculate the retrieved document to present and visualize the results. VOSviewer is application software that helps us to create maps based on network data, as well as simulate and explore them. VOSviewer may be used to create networks of scientific articles, journals, academics, research organizations, countries, keywords, and concepts. Co-authorship, co-occurrence, citation, bibliographic coupling, and co-citation connections can all be used to bind items in these networks. Web of Science, Scopus, PubMed, R.I.S., and Crossref JSON files can be used by this software. Network visualization, overlay visualization, and density visualization are all examples of visualization techniques. When dealing with massive maps containing thousands of objects, the zooming and scrolling interface enables a map to be viewed in great detail (Van Eck and Waltman, 2013).

We exported all data into Microsoft Excel after finishing data extraction for statistical analysis and rating various bibliometric indicators, such as top authors, cited papers, top countries, organizations, and journals. To visualize the relationship between names, keywords, countries, and so on, we used the VOSviewer software.

Results

Fifty nine documents were extracted by title search in the Scopus database. The search term used in the extraction was ICT and Bangladesh restricting by Title. 25(42.37%) was conference papers and 22(37.29%) was articles followed by book chapters 9(15.25%), review 2(3.39%), erratum 1(1.69%). Total authors, organizations, countries, and sources were 155, 95, 18, and 51, respectively. All keywords and author keywords were 391 and 188, respectively. Total cited references are 2044.

Table 2 and figure 3 shows most influential author in publishing documents. It is found that Dewan A.M. and Nazmin S.A. in the top rank, has co-authored in the 3 documents.

I. Dewan, A. M., Dewan, S. M., &Nazmin, S. A. (2008, December). The opportunities and challenges of using ICT by State Owned Enterprises in Bangladesh: Case of SOEs under Privatization Commission. In

2008 11th International Conference on Computer and Information Technology (pp. 611-616). IEEE.

II. Dewan, A. M., &Nazmin, S. A. (2008, May). The opportunities and barriers of using ICT by small and medium enterprises in Bangladesh: Case of SMEs in BSCIC industrial estates. In 2008 International Conference on Computer and Communication Engineering (pp. 656-661). IEEE.

III. Dewan, A. M.,&Nazmin, S. A. (2007, December). The opportunities of using ICT by small and medium enterprises in Bangladesh: Case of SMEs in Bangladesh small & cottage industries corporation's industrial estates. In 2007 10th international conference on computer and information technology (pp. 1-5). IEEE.

In addition, Ahmed A., Ashraf M., Habib A., Hossain M.K., Hussain F., Imran A., Khan N.M., Kuddus K., Mahtab N., Malik B.T., Mia M.B., Rahman M., Ramage M each of the authors has 2 documents. Figure 3 helps to understand the author's map visualization.

Table 2: Author in terms of documents publications

Author	Documents	Citations
Dewan A.M.	3	4
Nazmin S.A.	3	4
Ahmed A.	2	5
Ashraf M.	2	22
Habib A.	2	3
Hossain M.K.	2	9
Hussain F.	2	7
Imran A.	2	5
Khan N.M.	2	0
Kuddus K.	2	0
Mahtab N.	2	0
Malik B.T.	2	1
Mia M.B.	2	2
Rahman M.	2	1
Ramage M.	2	2

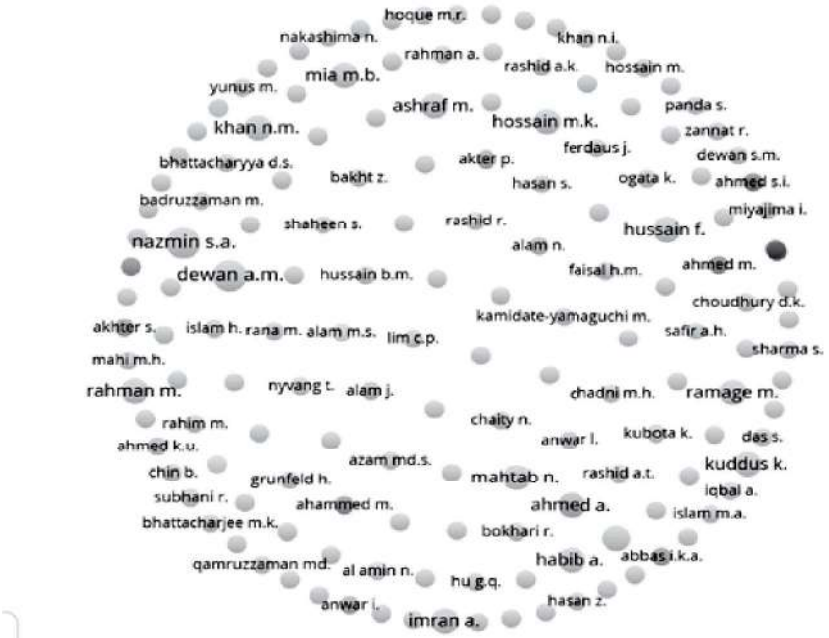


Figure 3: Author Visualization map

Top author in terms of citation

The total number of authors identified through statistical analysis is 155. The top 10 authors have been identified in terms of receiving citations in their documents (Table 3). It is found that Chadni M.H., Ferdaus J., Murshed M. has achieved highest citation (32) with just 1 paper while Ashraf M., with 22 citations in 2 publications ranked 2nd.

I. Murshed, M., Chadni, M. H., & Ferdaus, J. (2020). Does ICT trade facilitate renewable energy transition and environmental sustainability? Evidence from Bangladesh, India, Pakistan, Sri Lanka, Nepal and Maldives. Energy, Ecology and Environment, 5(6), 470-495.

II. Zahid, M. J. A., Ashraf, M. M., Malik, B. T., & Hoque, M. R. (2013, June). Information communication technology (ICT) for disabled persons in Bangladesh: Preliminary study of impact/outcome. In International Working Conference on Transfer and Diffusion of IT (pp. 652-657). Springer, Berlin, Heidelberg.

III. Ashraf, M., Grunfeld, H., Harris, R., Alam, N., Ferdousi, S., & Malik, B. T. (2011). An explorative study of ICT for Developmental Impact in rural areas of Bangladesh. Media Asia, 38(1), 22-31.

Table 3: Top author in terms of citation

Author	Documents	Citations
Chadni M.H.	1	32
Ferdaus J.	1	32
Murshed M.	1	32
Ashraf M.	2	22
Hanisch J.	1	21
Swatman P.	1	21
Islam Md.N.	1	13
Islam Md.S.	1	13
Hoque R.	1	11
Sorwar G.	1	11

Top organization in terms of document publication

The entire organization identified through statistical analysis is 95. Table 4 displays the top ten universities connected to the recovered records, with authors from the University of Dhaka, Bangladesh (3 documents) is in top position and Department of Public Administration, University of Chittagong, Chittagong, Bangladesh; Division of Research, Daffodil International University, Dhaka, Bangladesh; East West University, Bangladesh; Leeds Metropolitan University, United Kingdom; Shahjalal University of Science and Technology, Sylhet, Bangladesh has published 2 documents each.

However, in terms of the highest citation of the publications (Table 5) published by the authors of the belonging organizations; Department of Economics, Cumilla University, Cumilla, Bangladesh and school of Business and Economics, North South University, Dhaka, Bangladesh has achieved top citation of 32 for 1 document.

Table 4: Top organization in terms of document publication

Organization	Documents	Citations
University of Dhaka, Bangladesh	3	11
Department of Public Administration, University of Chittagong, Chittagong, Bangladesh	2	5
Division of Research, Daffodil International University, Dhaka, Bangladesh	2	0
East West University, Bangladesh	2	3
Leeds Metropolitan University, United Kingdom	2	0
Shahjalal University of Science and Technology, Sylhet, Bangladesh	2	3
Aalborg University, Denmark	1	2
Ahsanullah University of Science and Technology, Bangladesh	1	3
Asian Institute of Technology, Thailand	1	3
Australian National University, Australia	1	5

Table 5: Top organizations/institutions that received highest citation

Organization	Documents	Citations
Department of Economics, Cumilla University, Cumilla, Bangladesh	1	32
School of Business and Economics, North South University, Dhaka		
School of Computing and Information Science, University of South Australia, City West Campus, 27-29 North Terrace, Adelaide 5000, Australia	1	32
Department of Information Science and Library Management, University of Rajshahi, Rajshahi, Bangladesh	1	21
East West University Library, Mahakhali, Dhaka, Bangladesh	1	13
University of Dhaka, Bangladesh	1	13
Southern Cross University, Australia	3	11
Faculty of Information Technology and Communication Sciences, University, Tampere, Tampere, Finland	1	11
Digital Communication Leadership (Dclead), University of Salzburg, Salzburg, Austria	1	10
Vrije Universiteit Brussel, Brussel, Austria	1	7
	1	7

Country in terms of Documents and citation

The entire country identified through statistical analysis is 18. Accordant to Table 6 and 7, the influential countries were identified in terms of publishing documents and receiving citations. It is found that Bangladesh is at the top to publish the documents on the ICT and Bangladesh related documents with 39 documents equivalent to more than 66%. Australia is in the second position with 7 documents, followed by United kingdom with 6 documents, Japan 4, China 3; India 3; Canada 2; Malaysia 2; South korea 2; and Austria 1documents. Likewise, in terms of citation (Table 7), Bangladesh also achieved first place with 108 citations and the second position occupied by Australia with 44 citations. Figure 4 shows a visualization map of country for citation.

Figure 4: Visualization map of the country in terms of citation received

Table 6: Country in terms of documents

Country	Documents	Citations
Bangladesh	39	108
Australia	7	44
United kingdom	6	9
Japan	4	7
China	3	1
India	3	3
Canada	2	7
Malaysia	2	3
South korea	2	2
Austria	1	7

Table 7: Country in terms of top citation

Country	Documents	Citations
Bangladesh	39	108
Australia	7	44
Finland	1	10
United Kingdom	6	9
Japan	4	7
Canada	2	7
Austria	1	7
United States	1	5
Sweden	1	4
India	3	3

Co-occurrence of all keyword

In this section, we investigated the terms used in the title, all ICT and Bangladesh related documents to discover the hotspot of these topic in the documents. All keywords are retrieved 391. Table 8 shows that the most frequent terms are Bangladesh 6.91% (n = 27 repeats), ICT 4.35% (n=17), Developing Countries (n=9), Information Technology (n=9), Information and Communication Technologies (n=6), Information and Communication Technology (n=5), Communication (n=4), Rural areas (n=4), Government Data Processing (n=3), Human (n=3). Figure 5 represents the all keyword visualization map.

Figure 5: Visualization map of all keyword.

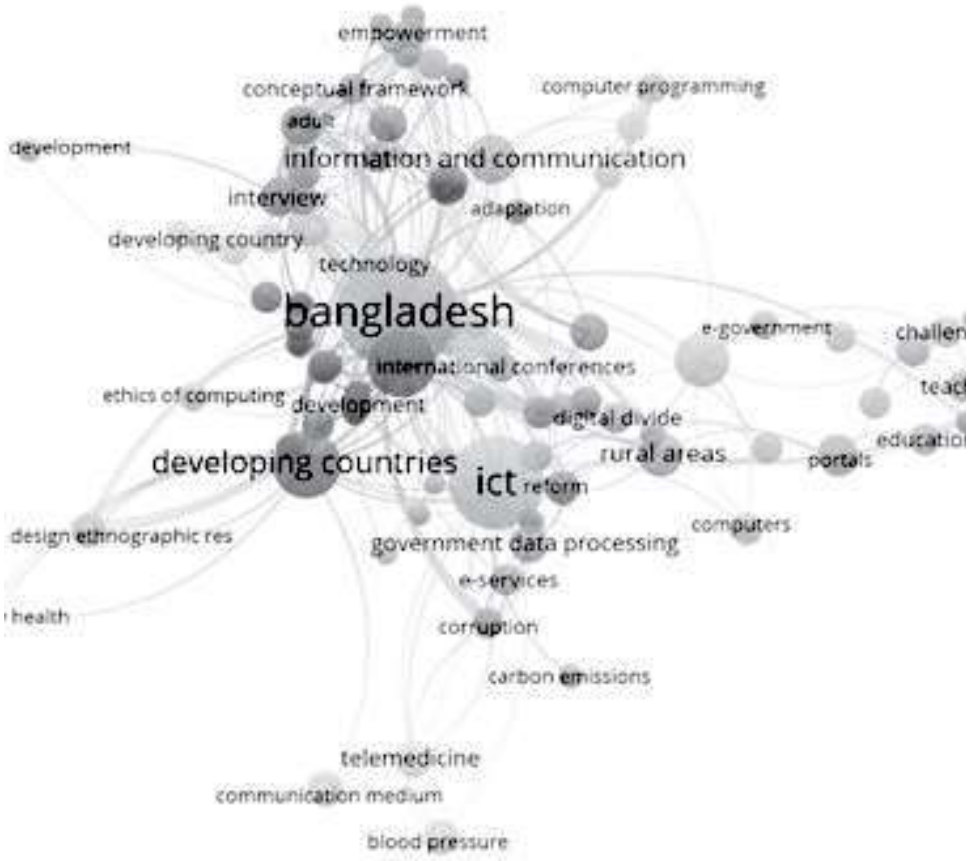


Table 8: All keyword co-occurances

Keyword	Occurrences
Bangladesh	27
ICT	17
Developing Countries	9
Information Technology	9
Information And Communication Technologies	6
Information And Communication Technology	5
Communication	4
Rural Areas	4
Government Data Processing	3
Human	3

Co-occurrence of author keyword

The counting of author keywords (n=188) revealed (table 9) that the most co-occurrence keywords Bangladesh and ICT. It shows Bangladesh 10.11% (n =19 repeats), ICT 9.04% (n =17 repeats), Ict4d 3 repeats and Challenges, Development, Digital Divide, E-Business, E-Services, ICT In Education, ICT Policy each repeated 2 times in author keywords throughout the data set .Figure 6 represents the author keywords map.

Figure 6: Author keywords.

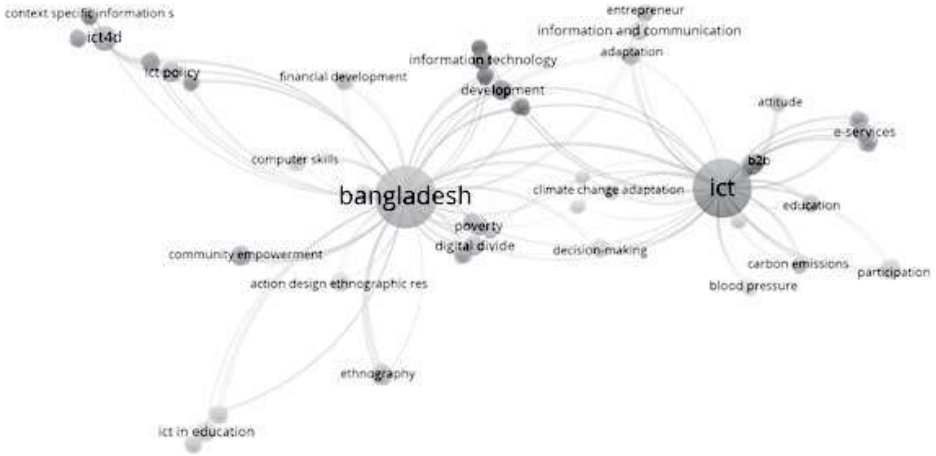


Table 9: Author keywords

Keyword	Occurrences
Bangladesh	19
ICT	17
Ict4d	3
Challenges	2
Development	2
Digital Divide	2
E-Business	2
E-Services	2
ICT In Education	2
ICT Policy	2

Document Sources

Based on the analysis, the study selected the top sources (Table 10 & figure 7) where authors mostly published documents. The total sources identified through statistical analysis is 51. IFIP Advances in Information and Communication Technology (4 documents), ACM International Conference Proceeding Series (3 documents), Asiascape: Digital Asia (2 documents), Electronic Journal of Information Systems in Developing Countries (2 documents), Journal of Creative Communications (2 documents) are the most influential sources where authors mostly published their documents. Thus, based on the publications, IFIP Advances in Information and Communication Technology is the top ranked sources.

In terms of top-ranked citation of the sources (Table 11), Energy, Ecology And Environment is in the top rank in terms of citation with 32 citations in just 1 document while Information Systems Frontiersis in 2nd rank with 21 citations.

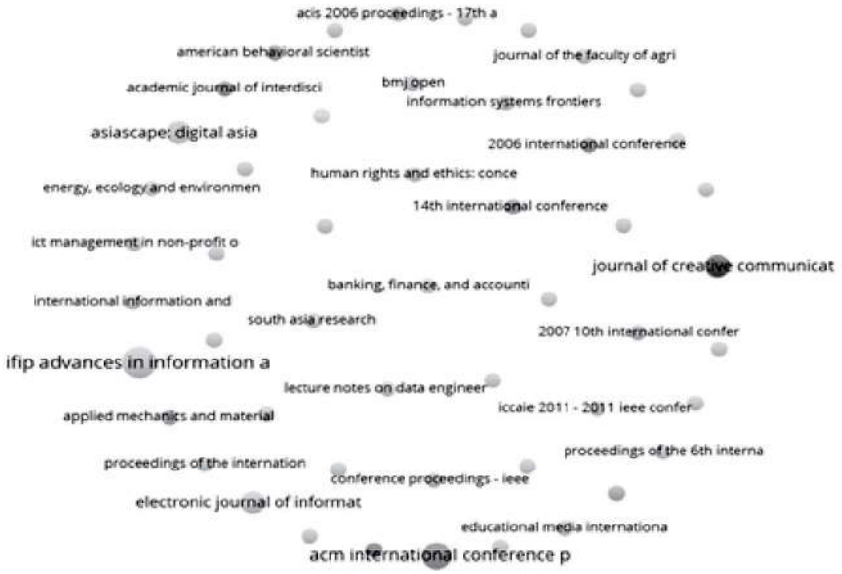
Table 10: Sources in terms of highest documents publications.

Source	**Documents**	**Citations**
IFIP Advances in Information and Communication Technology	4	6
ACM International Conference Proceeding Series	3	8
Asiascape: Digital Asia	2	0
Electronic Journal of Information Systems in Developing Countries	2	15
Journal of Creative Communications	2	5
14th International Conference on Computer Science and Education, Iccse 2019	1	1
2006 International Conference on Information and Communication Technology and Development, Ictd2006	1	0
2007 10th International Conference on Computer and Information Technology, Iccit	1	1
Academic Journal of Interdisciplinary Studies	1	1
Acis 2006 Proceedings - 17th Australasian Conference on Information Systems	1	0

Table 11: Top citation of the sources.

Source	Documents	Citations
Energy, Ecology And Environment	1	32
Information Systems Frontiers	1	21
Electronic Journal Of Information Systems In Developing Countries	2	15
Library Philosophy And Practice	1	13
International Information And Library Review	1	10
Acm International Conference Proceeding Series	3	8
Contemporary South Asia	1	7
Ifip Advances In Information And Communication Technology	4	6
International Journal Of Adolescence And Youth	1	5
Journal Of Creative Communications	2	5

Figure 7: Sources visualization map



Discussion and Conclusions

Following the lead of many other developing nations, the government of Bangladesh has implemented a number of ICT policies, acts, and initiatives in order to create a government that is transparent, inclusive, and responsible in order to promote economic growth and social development.

Although Bangladesh has seen both successes and failures in the execution of policy objectives in the past, the country is currently on the right track (Hasan 2012). Several government initiatives (such as access to information [a2i]) have been launched in recent years to support the implementation of ICT-driven activities, and the government intends to amend the existing policy to make it more relevant in light of the "emergence of 5G technology and the fourth industrial revolution" (New Age 2018). In Bandaldesh, the education, health, different offices are brought under digital platform to serve the nation like developed countries.

The importance of research on certain topics cannot be overstated. As a result, the hotspot of research trends, progress, problems, and possibilities for ICT in Bangladesh is highlighted in this paper.

The study's major goal was to conduct a bibliometric analysis of the retrieved materials related to ICT and Bangladesh. The analysis found that out of 59 documents, 25 (42.37 percent) were conference papers and 22 (37.29 percent) were articles, with book chapters 9 (15.25 percent), review 2 (3.39 percent), and erratum 1 (1.69 percent). There were 155 writers, 95 organizations, 18 countries, and 51 sources in all. The total number of keywords and the number of author keywords were 391 and 188, respectively. There are a total of 2044 references referenced.

With three documents apiece, Dewan A.M. and Nazmin S.A. are the most influential authors in document publication. Chadni M.H., Ferdaus J., Murshed M. have the most citations (32) with just one article, whereas Ashraf M. is in second place with 22 citations in two publications. Dhaka university has uppermost document publication record with 3 documents. Department of Public Administration, University of Chittagong, Chittagong, Bangladesh; Division of Research, Daffodil International University, Dhaka, Bangladesh; East West University, Bangladesh; Leeds Metropolitan University, United Kingdom; Shahjalal University of Science and Technology, Sylhet, Bangladesh are among the top organizations (2 documents each).

However, the Department of Economics, Cumilla University, Cumilla, Bangladesh, and the School of Business and Economics, North South University, Dhaka, Bangladesh, have earned the highest citation of 32 for one document published by the writers of the affiliated organizations.

Bangladesh is determined to be at the top of the list for publishing ICT and Bangladesh-related publications, with 39 documents accounting for more than 66 percent of the total. With seven papers, Australia is in second place. In terms of citations, Bangladesh took top place with 108 citations, followed by Australia with 44 citations. Bangladesh 6.91 percent (n = 27 repetitions) and ICT 4.35 percent (n=17) are the most keywords f all keywords. The most common co-occurrence of author keywords (n=188) was Bangladesh and ICT. Bangladesh has a 10.11 percent (n =19 times) and ICT has a 9.04 percent (n =17 repeats). The study chose the top sources where authors published papers based on the analysis. A total of 51 sources have been discovered using statistical analysis. The most influential sources where authors mostly

published their documents are IFIP Advances in Information and Communication Technology (4 documents), ACM International Conference Proceeding Series (3 documents), Asiascape: Digital Asia (2 documents), Electronic Journal of Information Systems in Developing Countries (2 documents), and Journal of Creative Communications (2 documents). As a result of the documents publication, the top-ranked source is IFIP Advances in Information and Communication Technology. Energy, Ecology and Environment is the top-ranked source in terms of citation, with 32 citations in only one document, while Information Systems Frontiers is in second place with 21 citations.

As a result, the bibliometric analysis provides a comprehensive analysis with a graphical map of the articles from many perspectives, including best author, nation, organization, sources, and keywords. The bibliometric study of the publishing patterns of ICT and Bangladesh has been done quite well. This study will be extremely useful for the authors and Bangladeshi policymakers in identifying the strengths of ICT research and which factors promote economic success. Additional ICT research will lead to more solutions and development opportunities.

According to a Scopus search (Title, Keyword, and Abstract), there are 67,137 articles on ICT throughout the world, including 1762 in India, 1218 in China, and 829 in the United States (Scopus, April 10, 2021). As a result, the more developed the country, the greater the emphasis on research.

Bangladesh (337 papers when searched by title, abstract, keywords, and 59 documents when searched by title to get particular documents) is keeping up with other countries in terms of study on current topics such as ICT. This research may encourage scholars, institutions, and countries to do additional research on similar topics. Future research might use cocitation and bibliographic coupling and can incorporate more databases, such as the Web of Science, dimensions, and other prestigious databases.

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Appendices

List of Article sought from Scopus for the study

Authors	Title	Year	Source title
Khan Tithi T., Chakraborty T.R., Akter P., Islam H., Khan Sabah A.	Context, design and conveyance of information: ICT-enabled agricultural information services for rural women in Bangladesh	2021	AI and Society
Rahman M., Das S., Tazim M.Z., Rana M., Tuhin R.A., Das A.K.	State of the Art of ICT based Telemedicine and E-health Services in Bangladesh	2021	Proceedings of the 6th International Conference on Inventive Computation Technologies, ICICT 2021
Khan N.M., Kuddus K.	Integrating ICT in Communicative Language Teaching in Bangladesh: Implementation and Challenges	2021	Lecture Notes on Data Engineering and Communications Technologies
Bhattacharyya D.S., Shafique S., Akhter S., Rahman A., Islam M.Z., Rahman N., Anwar I.	Challenges and facilitators of implementation of an information communication and technology (ICT)-based human resources management tool in the government health sector in Bangladesh: Protocol for an exploratory qualitative research study	2020	BMJ Open
Murshed M., Chadni M.H., Ferdaus J.	Does ICT trade facilitate renewable energy transition and environmental sustainability? Evidence from Bangladesh, India, Pakistan, Sri Lanka, Nepal and Maldives	2020	Energy, Ecology and Environment
Stillman L., Sarrica M., Anwar M., Sarker A., Farinosi M.	Sociotechnical Transformative Effects of an ICT Project in Rural Bangladesh	2020	American Behavioral Scientist
Khan N.M., Kuddus K.	Integrating ICT in English language teaching in bangladesh: teachers' perceptions and challenges	2020	Rupkatha Journal on Interdisciplinary Studies in Humanities
Qamruzzaman Md., Karim S.	ICT Investment Impact on Human Capital Development through the Channel of Financial Development in Bangladesh: An Investigation of Quantile ARDL and Toda-Yamamoto Test	2020	Academic Journal of Interdisciplinary Studies

Hussain F., Safir A.H., Sabie D., Jahangir Z., Ahmed S.I.	Infrastructuring hope: Solidarity, leadership, negotiation, and ict among the rohingya refugees in Bangladesh	2020	ACM International Conference Proceeding Series
Lim C.P., Ra S., Chin B., Wang T.	Leveraging information and communication technologies (ICT) to enhance education equity, quality, and efficiency: case studies of Bangladesh and Nepal	2020	Educational Media International
Rashid A.T., Rashid A.K.	Rural Ict Business in Bangladesh: A Credible Development Agent?	2020	South Asia Research
Sharma S.	Unanticipated movements: Examining the role of ICT in leadership and decision making during the Shahbag protests in Bangladesh	2020	Asiascape: Digital Asia
Aziz A.	Digital inclusion challenges in Bangladesh: the case of the National ICT Policy	2020	Contemporary South Asia
Hossain M.A., Sormunen E.	ICT Skills of Library and Information Science (LIS) Students in Bangladesh	2019	International Information and Library Review
Mahi M.H., Tarannoom T., Islam M.A., Khan M.M.	A web based interactive system to promote ict education in Bangladesh	2019	14th International Conference on Computer Science and Education, ICCSE 2019
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Ahmed J.U., Uddin M.J., Ahmed K.U., Al-Amin M.	Application of structuration theory in the context of ICT: The case of DESH microfinance in Bangladesh	2019	International Journal of Business Continuity and Risk Management
Alam J., Tasnim M., Obaid M.A., Palit R.	An ICT Based Micro-Plan Development for Strengthening Monitoring Mechanism of Vaccination Program in Bangladesh	2018	Proceedings - 2018 5th Asia-Pacific World Congress on Computer Science and Engineering, APWC on CSE 2018
Hussain B.M., Chen D.	Information communication technology (ICT) can change the way of women entrepreneurs run their businesses: A case study in Bangladesh	2018	PICMET 2018 - Portland International Conference on Management of Engineering and Technology: Managing Technological Entrepreneurship: The Engine for Economic Growth, Proceedings

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Zahurul Haque M.	International crimes tribunal (ICT) (Bangladesh): The issues of fairness and transparency	2018	Shifting Horizons of Public International Law: A South Asian Perspective
[No author name available]	Erratum to: Empowerment of the Rural Poor through Access to ICT: A Case Study of the Union Information and Service Centre Initiative in Bangladesh (Journal of Creative Communications, (2017), 12, 2, (81-97), 10.1177/0973258617708366)	2017	Journal of Creative Communications
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Mia M.B., Ramage M.	Use and management of conventional ICT and mobile technology in microfinance: A Bangladesh perspective	2015	Banking, Finance, and Accounting: Concepts, Methodologies, Tools, and Applications
Hasan S.	ICT policies and their role in governance: The case of Bangladesh	2014	Science, Technology and Society
Mahtab N., Mahtab N.	Understanding ICT: The potential and challenges for the empowerment of rural women in Bangladesh	2014	Human Rights and Ethics: Concepts, Methodologies, Tools, and Applications
Mia M.B., Ramage M.	Use and management of conventional ICT and mobile technology in microfinance: A Bangladesh perspective	2014	ICT Management in Non-Profit Organizations
Hasan S.	ICT policies and their role in governance: The case of Bangladesh	2014	Science, Technology and Society
Mahtab N., Mahtab N.	Understanding ICT: The potential and challenges for the empowerment of rural women in Bangladesh	2014	Human Rights and Ethics: Concepts, Methodologies, Tools, and Applications
Mia M.B., Ramage M.	Use and management of conventional ICT and mobile technology in microfinance: A Bangladesh perspective	2014	ICT Management in Non-Profit Organizations
Habib A., Badruzzaman M., Ahammed M., Iqbal A.	ICT: A tool to reduce corruption in Bangladesh	2014	ACM International Conference Proceeding Series
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Jahangir A.S.M., Hu G.Q., Rabiul Alam M., Roy R.B., Kibria M.G.	Improved ICT grid model for development of the Bangladesh	2013	Applied Mechanics and Materials
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Mahmud A., Sattar A.	'ICTization framework': A conceptual development model through ICT modernization in Bangladesh	2013	Proceedings - 2013 International Conference on Advanced Computer Science Applications and Technologies, ACSAT 2013
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Dewan A.M., Nazmin S.A.	The opportunities and barriers of using ICT by small and medium enterprises in Bangladesh: Case of SMEs in BSCIC industrial estates	2008	Proceedings of the International Conference on Computer and Communication Engineering 2008, ICCCE08: Global Links for Human Development

Dewan A.M., Nazmin S.A.	The opportunities of using ICT by small and medium enterprises in Bangladesh: Case of SMEs in Bangladesh small & cottage industries corporation's industrial estates	2007	2007 10th International Conference on Computer and Information Technology, ICCIT
Islam Md.S., Islam Md.N.	Use of ICT in libraries: An empirical study of selected libraries in Bangladesh	2007	Library Philosophy and Practice
Imran A.	Significant barriers to ICT adoption in the public sector in the least developed countries (LDCs): A case study of Bangladesh	2006	ACIS 2006 Proceedings - 17th Australasian Conference on Information Systems
Akther M.S., Onishi T., Kidokoro T.	ICT for poverty alleviation: A study on Bangladesh	2006	2006 International Conference on Information and Communication Technology and Development, ICTD2006

Significance of Open Access (OA) Publishing Model for Libraries and Information Services: A comparative analysis of City, University of London Institutional Repository (CRO) and Dhaka University Institutional Repository (DUIR)

Shohana Nowrin *
Mashiat Tabassum **

Abstract

One of the phenomena that has changed the traditional way of disseminating knowledge is the open access platform. The objectives of this study are to explore the significance of open access publishing model in perspective of library and information services, and to make a comparative study between the institutional repositories deployed at the City, University of London, and the University of Dhaka. The paper is based on qualitative study where the importance of open access publishing model has been examined by extensive review of relevant literature. The comparisons of these two different institutional repositories have been made by meticulous browsing of respective websites as well as interviewing selected library staff of Dhaka University Library and exploring features, services, and policies offered by them. The findings of the comparison show that the repository of the City, University of London is far more advanced and enriched than Dhaka University Institutional Repository with regard to contents, usage of software and research information management system, submission process, and so on. The study concludes by putting forward some suggestions for ensuring the development of Dhaka University Institutional Repository in showcasing its research contents and increasing discoverability.

Keywords: Open access, Institutional repositories, open access publishing, Bangladesh, United Kingdom.

Introduction

The concept of publishing refers to the 'way' of making information available to the public. Such 'way' may include making publishing happen using print media like newspaper, journal, periodical, magazine, book and many others or

* Assistant Professor, Department of Information Science and Library Management, University of Dhaka
** Assistant Professor, Department of Information Science and Library Management, University of Dhaka

electronic media like blog, e-book, e-journal, website and so on or through any other means for distributing the scholarly work and/or any other information among the wider audiences. Since the publishing through print media have been the most popular and dominating form of publishing for a very long time, publishing of any information was almost solely dependent on that form until very recently. Therefore, traditionally the scholarly works were either dependent upon the academic societies or the publishing authorities for being exposed up to the mass population. Though publishing through the electronic form have been in use for quite some time now but its popularity rose ever since the internet was introduced and got very popular among the public. Basically, alternative forms of publishing other than the use of print form got popularity because of the influential factors including, but not limited to, having quick access to the wider range of audiences, easy to customise as per the users' requirements, time and cost effectiveness, efficient and convenient management opportunities of the institutional scholarly outcomes, sustainable preserving facilities, and others. However, among several other forms of publishing, Open Access (OA) movement is one of the significant and rapidly growing models of publishing. Even though the OA movement was first introduced during the 1960s, but the use of OA was really climbed up during 1990s when the internet got popular among public (Roy, Mukhopadhyay, and Biswas, 2012). In the process of giving access to any publications using OA model, the Institutional Repositories (IR) play a very crucial role. Accordingly, open access institutional repositories are also invaluable in the context of providing library and information services.

Literature Review

Open Access (OA) Publishing Model

Currently the largest number of scholarly publications are being produced in the human history and the cost of subscription to those resources are also jumping up day by day accordingly. Therefore, a range of publishing models have come out and those are getting popular gradually. In regard to academic publications, Open Access (OA) model is very popular among the authors and the subscribers because this offers the flexibility to both parties and in majority of the cases it is free from monetary transaction. By removing the fees and permission barriers, the OA model provides access to such scholarly research papers which may also include the peer reviewed publications in completely

free of cost with the opportunity to reuse and redistribute those in compliant to some restrictions (Eve, 2014). In respect of OA literature, it was described by Suber (2003) as the resources which are free to use over the public internet without requiring any further permission from anybody for searching, reading, downloading, copying, printing, distributing, redistributing, or having access to full text of articles or using them with valid legal purposes without monetary, legal, or technical restrictions but only having some basic technical efficiency of using internet. Similarly, Prosser (2003) argued that the OA literatures are usually presented by the scholars on the public domain for free and unrestricted access for mass population of the world without requiring any monetary consideration. However, the definition provided in the Bethesda Statement has set two criteria which the OA publications need to comply with, and such criteria are presented in the following.

1. *"The author(s) and copyright holder(s) grant(s) to all users a free, irrevocable, worldwide, perpetual right of access to, and a license to copy, use, distribute, transmit and display the work publicly and to make and distribute derivative works, in any digital medium for any responsible purpose, subject to proper attribution of authorship, as well as the right to make small numbers of printed copies for their personal use.*
2. *A complete version of the work and all supplemental materials, including a copy of the permission as stated above, in a suitable standard electronic format is deposited immediately upon initial publication in at least one online repository that is supported by an academic institution, scholarly society, government agency, or other well-established organization that seeks to enable open access, unrestricted distribution, interoperability, and long-term archiving (for the biomedical sciences, PubMed Central is such a repository)"* (Brown et al., 2003).

Subsequently, the Budapest Open Access Initiative (2005) outlined two main forms of OA publishing models namely OA institutional repositories and OA journals. Alternatively, Harnad et al., (2004) argued that the OA model can be formed by following two primary roads and the author named those roads as Gold OA and Green OA.

Gold Open Access (OA)

In the Gold OA model, the publishers make full and original research papers available to the public at free of cost either as OA journal or in book format. It is obvious that the readers under the gold OA do not pay any monetary compensations for consuming such contents of literatures neither they are required to acquire any organisational login credentials or whatsoever. In consideration to the pecuniary interests, it was also observed in the gold OA model that in most cases the entire contents are completely free from monetary charges but in some cases, it follows hybrid style in which only a number of selected research papers are offered for free access from a third party paid journals (Eve, 2014). Despite the effort of gold OA model to keep the contents completely free of cost for the users, in real life scenario there are some associated costs involved in it for copyright, editing, formatting, review, filtering, license, distribution and archiving the contents, and such are mostly financed by the charitable organisations of the community or by the involvement of volunteers or by the use of free open source software in order to achieve the goal of publishing research papers free from any charges (Morgan, Campbell, and Teleen, 2012).

Green Open Access (OA)

Unlike gold OA model, in the Green OA model the research papers do not necessarily get collected from the published OA journal but those are rather archived by the authors in the repositories. There are several ways by which such papers can be made available. In some cases, the research articles can be made available in the repositories uniquely when in other cases a copy of the article, which is in process to be published or already has been published in a third-party journal, can be made available in the repository by showing the status heading of referred (post-print) or unreferred (pre-print) respectively or both (Morgan, Campbell, and Teleen, 2012). Generally, the green OA repositories are classified in two ways namely the disciplinary repository (for example arXiv-for physics) which is designed for a single academic discipline and the institutional repository that refers to "a set of services that a university offers to the members of its community for the management and dissemination of digital materials created by the institution and its community members" (Lynch, 2003).

Open Access (OA) Institutional Repository

The long known 'serial crisis' and the sufferings due to this for libraries and research organisations has been resolved, at least to some extent, by the significant roleplay of OA publishing model (Young, 2009). The development of OA Institutional Repository (IR) is one of those significances. Basically, IR is a type of digital repository belong to and operated by the institutions themselves for storing and organising their necessary collected electronic information resources with an aim to distribute those among the users. Such kind of repository can be defined according to Hayes (2005) as, "Digital repository is where digital contents and assets are stored and can be searched and retrieved for later use".

Since the IR is a latest technological development, the activities of IR consist of collecting, storing, organising and managing the published electronic academic resources of the students, faculty members and other employees of the educational institutions. In respect of the purposes, features, and standards of the IR, Lynch (2003) observed that "... an effective institutional repository of necessity represents a collaboration among librarians, information technologies, archives and records managers, faculty, and university administrators and policymakers." His study also found that the IR offers certain services across the community through the act of managing and disseminating the electronic information resources which are either created by the institution itself or its associate members. In consideration to the academic institutions, their repositories generally include e-journals, thesis papers of the students, dissertations, datasets, range of faculty works and so forth. It was shown in the position paper of the SPARC (Scholarly Publishing and Academic Resources Coalition) about the IR that "an institutional repository is a digital archive of the intellectual product created by faculty, research staff, and students of an institution, with few, if any, barriers to access" (Crow, 2002). The characteristics of the IR were further observed by Johnson (2002) as of consisting of four main elements namely scholarly, institutionally defined, open and interoperable, and cumulative and perpetual. In recent years, all libraries have been facing severe challenges in maintaining high standard of the services and in-depth series of collection due to various newly emerged factors like cost, imposed access restrictions, initiation of latest technological use, fast changing of pattern of the scholarly practice, unparallel patron expectations,

etc. However, there are several reasons of establishment of the IR including supporting the OA movement, offering access facilities to the public funded research, supporting preservation, providing OA to the institution's output, and so on (Roy, Mukhopadhyay, and Biswas, 2012).

Among many factors, undertaking the Open Archive Initiative (OAI) in 1999 can be considered as one of the most significant events in growing the popularity of institutional repository (Jones Andrew, and MacColl, 2006). It was argued by Sompel and Lagoze (2000) that the origin of the idea of OAI actually lies in the "Universal Preprint Service" which was subsequently transformed into open access movement. The metadata formats used in all the IR are exactly the same, like the bibliographic details are followed by author names, date, titles of the article, abstract, institutional affiliation, and so forth, in order to ensure the interoperability on organising the contents.Usage of the common protocol by ensuring low barrier mechanism for repositories namely Open Archive Initiative Protocol for Metadata Harvesting (OAI-PMH) also ensures the interoperability among the repositories. Furthermore, when creating OA online databases by inserting contents to those repositories, in respect of development of the indexes the web search engines like Google or Google Scholars are mainly used to ensure free access to those literatures for the readers globally (OASIS, 2009). To support the whole process of interoperability, currently, many of such open-source software are also available in the market which can build and maintain OAI-PMH friendly archives (Suber, 2004). Among many others, the mostly used IR software platforms in current use are EPrints, DSpace, Bepress (Digital Commons) (New World Encyclopedia, n.d.).

According to statistics presented by ROAR (Registry of Open Access Repositories) and OpenDoar (Directory of Open Access Repositories) websites, developed by the Securing a Hybrid Environment for Research Preservation and Access (SHERPA), there are currently 1400 repositories worldwide which were established at the rate of one in every day for the last three years. However, the statistics changes every day, and the latest updated information can be easily extracted from the two websites mentioned above. Besides, the locations and the numbers of the repositories can also be pointed out over the world map presented by the Repositor66 (OASIS, 2009).

Significance of Open Access Institutional Repository

In the arena of digital technology and scholarly communication, the open access IR have great significances; especially in respect of storing and disseminating literature across the world under the names of respective institutions, and finally contributing those towards the aggregate global research outputs thereby. The institutions emphasise on the quality and the quantity of the publication in the IR to a great extent because such factors have great impact on increasing their prestige. Generally, in an institution, the total collection of the scholarly outputs, created by its researchers, are centralised in one place. When those collections are organised in the IR, it reflects the scholarly contributions of the institution altogether, as well as the inter-disciplinary contribution of the institutions towards the world of knowledge and thus good quality contributions upholds the prestige of the concerned institution. Besides, the existence of IR has created opportunities to provide increased access to research for the readers, help upholding the competition policy, break down the chain of monopoly control of the market enjoyed by the journals, bring economic stability in the market, and so forth (Crow, 2002). In the perspective of significances of IR, quite a number of similar observations provided by different authors can be found. According to Pfister and Zimmermann (2008), the IR works as an impact factor in the area of increasing visibility and improvement of scholarly outcomes, building and maintaining strong internal communication chain within the organisation and fostering paradigm shifting of the scholarly publishing model. Though the authors only mentioned about the improvement of internal communication here, the IR also promotes good external communication by default towards other institutions, their members and the public by its products of open access scholarly publications. Earlier, Stanger and McGregor (2006) also found that IR has great impact in respect of ensuring easy accessibility and increasing visibility to the research outputs of any given institution. From a different perspective, Yeates (2003) observed that the establishment of IR benefits with increasing the opportunity of knowledge sharing options, offering easy, rapid, and user-friendly intellectual communication platform, saving investment by reducing the expenses of information and content management system.

As IR makes the process of distribution and making literature available very convenient by its open access publishing nature, the audiences of the developing countries are hugely benefitted by this. In the past, the researchers

used to face huge challenges there in having access to information to their relevant field of study due to the financial reasons as many of the journals were very expensive to subscribe and most of the libraries could not afford such facilities with high subscription fees. In this case, the OA publishing model has brought to the developing countries with the opportunity to reach out the world without intervention, which made them able to distribute their research papers globally and consequently establishcommunication and preservethe scholarly work for public (Islam and Akter, 2013). Furthermore, institutional repositories tend to demolish the dominance of commercial publishers on the research scholars by ensuring democratic and impactful communication among them (Bashir et al., 2021)

In addition to serve the academics, OA repositories also brings huge opportunities for the different groups of people of the society. Only through a mere internet connection it can facilitate with the access to information for a wide range of people and can support them with the benefit of lifelong learning process. Immense number of groups of people including ordinary citizens, health professionals, medical patients, scientists, NGOs, linguistics and translation service-oriented professionals are also benefitted by the literature exposed up using OA publishing model (Tennant et al., 2016). This must be noted here that the beneficiary list of people by the OA movement are not limited to any groups rather everyone can acquire the necessary information from there according to their needs. It is argued by Willinsky (2006) that it is the fundamental human right of any human being to have access to the knowledge and such right is also correlated with making him/her capable to pursue and defend other rights. Due to the free nature of OA publishing model, it attracts more users than the subscription required publishing. Therefore, the citation graph of the OA publications, generally, also climbs higher compared to subscription-based publications (Davis et al., 2008). The library and information service providers are also immensely benefitted by the usage of IR as in the previous time they used to rely on either purchasing or inter library borrowing method for a required academic literature, but now it can be conveniently managed in the electronic format from an IR completely free of cost. In consideration to preservation of the information resources in the IR, as the contained information are digital in nature, saving space and time, quick and easy to organise, sustainability, and minimum costs are some of the key

advantage factors. It is argued that preserving information resources must be the topmost priority in the present time because the future standard of the publishing practice is still not fully settled yet as the sustainability of the current profit-making publishing model is in question and also dramatic changes are happening in the industry by the newly emerged OA model (Buehler and Boateng, 2005).

Emergence of Institutional Repository in the UK

The concept of IR is very new, and it was not fully developed until early 1990s. Rumsey (2006) pointed out that UK Higher Education (HE) and JISC (Joint Information Systems Committee) are playing a significant role in developing and funding the institutional repositories in the UK. It is the 'arXiv' which came into existence as the first IR in 1991 but it was focussed on a particular discipline which was the field of physics in this case. Following the footsteps of 'arXiv', subsequently other closely related subjects-oriented IRs were also established. However, all these IRs were also focused on only to their respective fields of study such as CogPrints for the discipline of cognitive psychology, EconPapers for the subject of economics, and UKPMC (United Kingdom PubMed Central) for biomedical and life sciences. It is observed that the arXiv had never set up a standard for the other repositories as it was mainly focussing on single area of study. Subsequently, the standard model of repository was established by the institutions where literature of various subject matters are included. Besides, the scholars also prefer such types of repositories due to their quite a number of qualities ranging from trustworthiness, sustainable nature, and credibility. Consequently, a total number of 315 IRs have been able to make their position in the OpenDOAR (Directory of Open Access Repositories) .

Institutional repository in Bangladesh

A milestone was created ever since Bangladesh got an opportunity in 2006 to access online resources by the inception of BIPC (Bangladesh INASP-PERI Consortium). In 2005, Rajshahi University discussed with INASP (International Network for the Availability of Scientific Publications) to join with the

[1] https://v2.sherpa.ac.uk/view/repository_by_country/United_Kingdom.html
[2] https://v2.sherpa.ac.uk/view/repository_by_country/Bangladesh.html

Programme for the Enhancement of Research Information (PERI) as an attempt to subscribe electronic resources (Tariq, 2010). However, when the direct mediation between INASP and the publishers was stopped in 2018, the need for accessing to e-resources brought out a new consortium called LiCoB or Library Consortium of Bangladesh (Habiba & Ahmed, 2020). Such crucial movements gradually impelled library professionals to connect the students, and researchers with the scholarly works of their respective institutions. Consequently, BRAC University library served as the pioneer in introducing digital institutional repository in Bangladesh using DSpace in 2008. This project was funded by INASP for enabling the university community to access their intellectual output (Rahman and Islam, 2014). Earlier, North South University library took an initiative to develop online e-journals repository by their self-developed software. These significant initiatives enabled library and information professionals to connect the readers and scholars with national and global knowledge base. By analysing the data found from OpenDOAR, Elahi and Islam (2018) identified that 12 open access repositories belong to Bangladesh. As of April 2021, a little more development can be observed as three more repositories have been listed in OpenDOAR . Out of 15 repositories, 13 are institutional, and the other two are governmental and disciplinary repositories.

Objectives of the study

This paper illustrates the significance of OA publishing and its impacts on library and information services by focussing on the features of the City Research Online (CRO), an institutional repository of the City, University of London, and the Dhaka University Institutional Repository (DUIR). Issues related to the contents, use of specific software, costs, policies of copyright, submission and preservation of contents, metadata, interface of the repositories and so on have been discussed precisely to show how the IR works and contributes towards the OA publishing. The main objectives of this study are to:

1. explore the significance of open access repositories in research work.
2. make a comparative study between City Research Online (CRO) and Dhaka University Institutional Repository (DUIR) in terms of contents, operation and software usage, policies for metadata, copyright, submission, preservation etc.; and
3. Propose some possible recommendations for overall development of DUIR.

Methodology

The present study is qualitative in nature. Qualitative study can be defined as "any kind of research that produces findings not arrived at by means of statistical procedures or other means of quantification" (Togia and Malliari, 2017, cited in Strauss and Corbin, 1990, p. 17). In order to make a comparison, comprehensive searching and browsing of the websites of CRO and DUIR was carried out to explore the features, and services offered by them. Along with the review of relevant literature, some of the library staff of these repositories were also interviewed to gather information on the functions and policies essential for operating them in two different geographical locations. Moreover, the information collected from Dhaka University library staff provided significant insights into making the recommendations proposed in this study.

Comparative analysis of City, University of London Institutional Repository and Dhaka University Institutional Repository (DUIR)

City Research Online: An Institutional Repository of the City, University of London

It was observed that the OA movement got ignition through the establishment of IR because it is an economical option which has the most immediate appeal towards the users (Harnad, 2003). Most of the universities of the world, therefore, already have set up their own OA institutional repository with an aim to "capture the scholarly output of an institution and to maximise the research impact of this output" (Chan, 2004). In fulfilling the current demands of the academic world and maintaining scholarly communications, the City, University of London has also created an institutional repository named City Research Online (CRO). Some of the important features of CRO along with figure are analysed accordingly.

Generally, CRO contains scholarly literature created by the staffs, faculty members, and research students of the City, University of London by including the bibliography details of those literature in compliance with the copyright law and with the consent of the authors. CRO might be considered as the primary source of authentic research publications produced by the personnel associated with the City, University of London.

[2] https://v2.sherpa.ac.uk/view/repository_by_country/Bangladesh.html

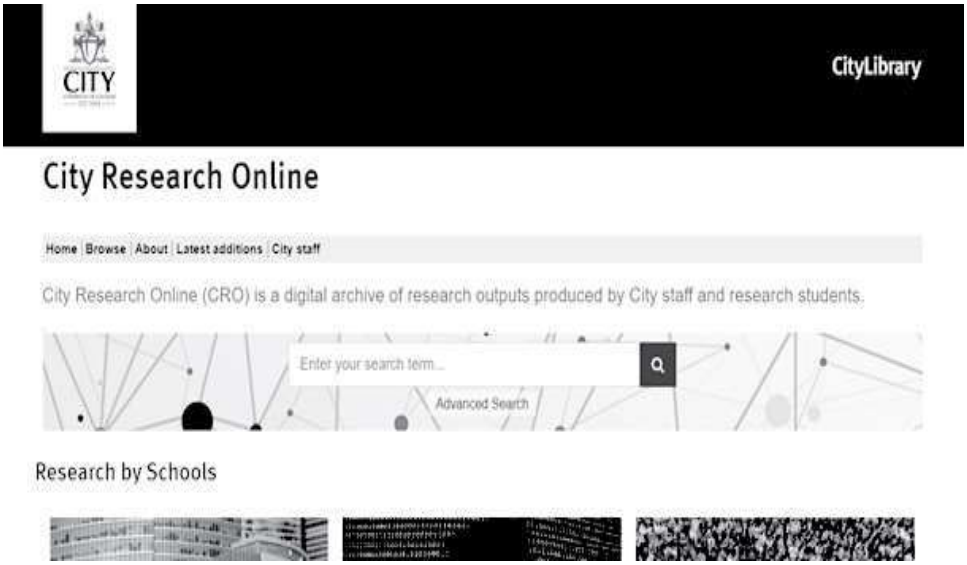

Fig. 1: Screenshot of the home page of CRO Institutional Repository
(Source: http://openaccess.city.ac.uk/)

Any contents kept in the CRO can be searched by entering the metadata information of the respective content. Generally, the metadata entries of any given content include title, name of authors, department, subjects, and year. Accordingly, the metadata entries are hyperlinked to such web page that presents relevant content description as well as full record of the content which includes abstract, preview and download option, Uniform Resource Identifier (URI), licence status, monthly download status and so forth. (see figure 2).

CRO has been set up with two different but correlated systems namely Current Research Information System (CRIS) and Open Access Repository with full text version. Generally, the CRIS uses the Symplectic Elements software to search over the web for any contents created by the member of staff, academics or students of City, University of London automatically and after finding such contents it sends those over to the respective authors for authentication. Basically, it is a research information management system used to create a comprehensive track record of research works produced by the institution and its associates. In contrast, the open access repository contents, which are full text research papers, are examined by the subject based

specialists to ensure that such materials are authentic, compliant with the copyright law, free from publishers' embargo, and no other limitations are imposed to make those openly accessible to the wider public. The city open access repository uses the EPrints software.

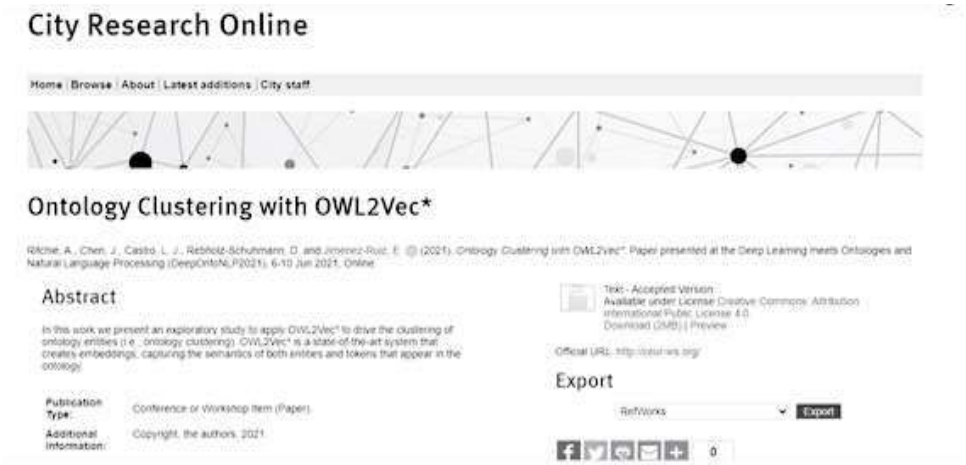

Fig. 2: Screenshot of the metadata of a record, with the assigned URI
(Source: https://openaccess.city.ac.uk/id/eprint/25933/)

The login page of the CRO for accessing the membership accounts by the authors looks like the following figure provided (see figure 3).

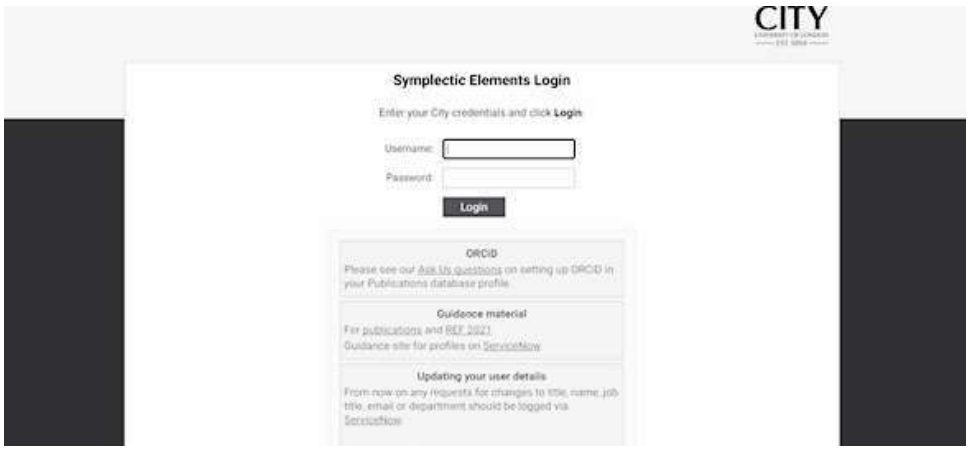

Fig. 3: image of web interface showing CRO database Login page
(Source: https://publications.city.ac.uk/login.html)

Dhaka University Institutional Repository (DUIR)

The University of Dhaka is the largest and oldest public university in Bangladesh which was established in 1921 (Ahmed & Shoeb, 2009). As an integral part of this university, Dhaka University Library (DUL) started its journey on 1st of July 1921 with 18,000 book. Currently, 0.68 million of books and magazines, along with 30,000 rare manuscripts have made the library to own the largest collection in Bangladesh .

In order to facilitate research and inspire the researchers, DUL created its own institutional repository named Dhaka University Institutional Repository (DUIR) in June 2013. Scholarly materials created by the teachers, staff, students or researchers of the university are deposited in the DUIR. All students and researchers pursuing degree in Dhaka University must submit their thesis/ dissertation to Dhaka University Library which are then deposited in DUIR. MPhil, and PhD researchers need to submit the final version of their dissertations to the Dhaka University library to be considered for inclusion in the DUIR with the written approval of the Chairperson of the respective department or Supervisor. Dissertations are made accessible after the respective researchers are awarded their degrees by the university. Similarly, faculty members who are on study leave for pursuing higher degree must also submit their dissertations after joining back to the university.

In order to promote academic integrity, DUIR uses 'Ithenticate' plagiarism checking software for detecting plagiarism of the submitted research works. At present, a total of 1357 MPhil, PhD, and Masters' theses dissertations are stored in DUIR.

In case of technical implementation of DUIR, the DSpace has been installed on Debian operating system. Figure 4 shows the homepage of Dhaka University Institutional repository which is located at www.repository.library.du.ac.bd. Contents have been arranged into 30 communities. Some of them are faculty of Arts, faculty of Biological Sciences,

[3]https://www.du.ac.bd/home/office_and_admin/lib#:~:text=Dhaka%20University%20Library%20started%20as,in%20the%20post%20in%201922

[4]https://www.du.ac.bd/home/office_and_admin/lib#:~:text=At%20present%20the%20Dhaka%20University,also%20been%20collected%20in%20microform

faculty of Business Studies, faculty of Earth and Environmental Sciences, faculty of Science, Institutes, etc. A feature named 'Recently added' can also be found on the homepage of DUIR.

Fig. 4: Screen demonstrating the homepage of DUIR (Source: repository.library.du.ac.bd:8080)

Nature of contents and their formats preserved in CRO and DUIR

A variety of scholarly publications of different levels are included in the CRO. In the case of research articles, CRO includes those either in the version of 'accepted and submitted' or in 'published' version by complying with the copyright policy. Other types of literature are book chapters and books, doctoral theses, conference papers, working papers, multimedia, and all other types of research.

The contents of DUIR include theses and dissertations, journal articles, conference and workshop papers, reports and working papers. However, the maximum number of contents fall into PhD dissertation category, followed by MPhil and Masters thesis dissertations.

Uploading policies and procedures

There are three ways either one of which can be followed to make a content available in the CRO, such as the materials can be collected using the CRIS system, the author can upload by himself, or the CRO team can make it done on behalf of the author upon request and after gaining required consent.

Among the three ways, the materials collected through the CRIS are of most convenient to use. It requires a mere one click to download all the research works in one go, upload those to the system in full text version, and export the relevant information to the references management software. Moreover, the papers collected using the CRIS increases the web presence of City, University of London. Contents contained in CRO are also free from any restrictions of subscription which benefit the audiences who cannot afford the subscription-based journals. Therefore, all it requires is a mere internet connection to access this vast ocean of knowledge. It was noticed that the scholarly materials included in the CRO have got a very high citation rate which makes good sense because the visibility ranking of CRO over different search engines like Bing, Google Scholar and Google is also very high which may have led to find the research papers easily. Most importantly, the CRO is a sustainable platform for City family which accumulates all their works in one place and preserve those for the future. The submission process of any scholarly contents in the CRO consists of seven steps. All those steps can be completed by simple point and click method along with writing up the respective metadata information in the relevant fields. However, the required metadata information, generally include author details, title of the paper, date of acceptance and publications, and others. (see figure 5).

Unlike CRO, the authors are not allowed to upload the contents by themselves in DUIR. Uploading contents in the DUIR involves some steps. First of all, researchers and faculty members submit their papers to their own departments. The departments send the research works to the control office of the university. The qualifications of the papers are finally checked by the DUIR, such as required file and format of the scholarly output, adherence to copyright policy, etc. (Jesmin and Tabassum, 2019). The materials must be submitted in digital format.

Fig. 5: Screenshot showing the steps of the submission process (Source: https://libanswers.city.ac.uk/faq/182499)

Copyright regulations

All the full text research papers contained in the CRO repository are subject to copyright law where some of the publications may also be subject to copyright law of multiple jurisdictions. However, it is clearly prohibited to use any of the contents of CRO for commercial purposes. Besides, a brief terms and conditions on 'copyright and reuse policy' documents of any literatures from the CRO are also, generally, kept attached with the respective literature itself. The City Library is also constantly working with the publishers who allow the institutions to archive the published contents. In most of the cases, such contents can only be archived by subject to compliance with the publishers' OA terms and conditions policy. The authors are encouraged to either explore the SHERPA RoMEO website or alternatively contact the CRO member of staff to become fully aware of the copyright and self-archiving policies of any publishers.

Moreover, the open access IR policy documents are also attached in the CRO website which clarifies several issues in order to void any conflict of interests under four policy headings like metadata policy, data policy, takedown policy, and preservation policy. These policies reiterate again and again that the contents included in the CRO are only for the personal use and not for any commercial purposes. It is also mentioned there that the CRO is not a publisher but a mere archive. Therefore, in respect of preserving the research papers, the CRO would like to preserve those for indefinite period of time. Furthermore, if the CRO gets shut down ever, its contents will be transferred to another suitable archive.

On the other hand, Dhaka University Institutional Repository Policy approved by the Syndicate of the university on 23 June 2013 reported that although the authors will hold the copyright, they are supposed to grant the Dhaka University Library a non-exclusive license permitting the library to preserve and distribute the deposited items. Since most of the publishers allow post-refereeing research papers to be submitted in repositories, the authors or submitters have to check respective publishers' policy and the submitted items will only be made available to the public after checking the copyright permissions provided on the website of Sherpa Romeo. Research work will be removed as soon as any copyright violation is detected.

Availability of several options for browsing DUIR

Readers can browse the entire collection of DUIR through a number of options, such as

Fig. 6: Screen showing browsing by issue date (Source: repository. library.du.ac.bd:8080/browse)

Browsing by issue date

Along with communities and collections, DUIR provides its users with several options for browsing, such as by issue date, authors, titles, and subjects. As illustrated in figure 6, one can search by our required month and year as shown in the figure and the results can be arranged both in ascending or descending order.

Browsing by title and subject

While browsing by title, readers can type first few letters of the title or directly go for alphabetical browse option (illustrated in figure 7). Besides, a number of subjects have been added alphabetically in DUIR. Users can either browse over these listed subjects or can search by typing the specific subject into the search box. Similarly, readers can also search contents by typing or by selecting the specific letter of the author's name.

Fig. 7: Screen showing browsing by title (Source: repository. library.du.ac.bd:8080/browse)

The entire collection of DUIR is open access and provides its users with full text documents. However, the 'log in' and 'register' options are reserved only for library administrators for uploading files and maintaining the repository. The materials of DUIR can be searched by title, author, faculty, department, and date. The retrieved item is hyperlinked to a web interface showing the URI, abstract, description (whether it is MPhil thesis, PhD thesis, or Master's dissertation). If it is clicked on the full record option of the individual item, the hyperlink would direct to another interface where the resource has been described using Dublin Core (DC) metadata element set as shown in figure 8.

Fig. 8: Screen showing some of the resource descriptions in DC metadata format (Source: repository.library.du.ac.bd:8080/handle/123456789/1047?show=full)

Use of filter while searching

The users can narrow down their search results by using filters containing or not containing specific terms as illustrated in figure 9.

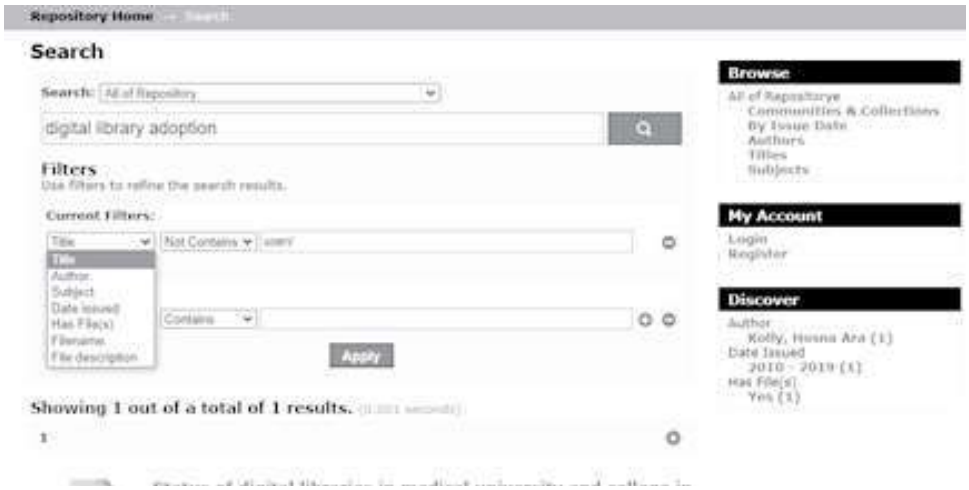

Fig. 9: Screen displaying search result using filter

Recommendations for DUIR

Although both repositories share the same objectives, that is to enable the researchers and students to get the scholarly contents freely and easily, a number of differences can be found between them. It is apparent from both IRs that the CRO has got far more collections compared to DUIR. In addition to this, the CRO also has mutual arrangements for open accessibility with larger number of publishers and/or resources in contrast to DUIR. Undoubtedly, the CRO is more user friendly in terms of operability and speed in exploring the website, using system software for operation, system deployed software for collecting the resources automatically as well as organising and preserving them for the patrons. On the other hand, in DUIR the web hosting is very slow, IR software is not the market leader, and web interface is not interactive enough. City Research Online is much more enriched than Dhaka University Institutional Repository in terms of software used, size of the collections, usability and interactivity of the interface, and so on. The study suggests the following recommendations providing insights into making DUIR more advanced.

1. Unless it is contradictory with the publisher's agreement or otherwise violation of any copyright law, necessary regulations should be in place making deposition of scholarly works mandatory in DUIR which are done by the faculty members, research students, and staff of the Dhaka University.
2. The university should regularly organize in-house training and programs for making researchers acquainted with the submission, content type, and copyright policies of DUIR.
3. Web analytics should be adopted for allowing not only admin, but also users to see the statistics of views and download of the contents.
4. The university should take necessary steps to increase the number of files in the DUIR, and then to include the repository as an indicator to be considered by "Webometrics ranking of world universities" or other university ranking websites. This is due to the fact that a large collection of enriched local contents of the repository will possibly increase the visibility as well as ranking of the university in global academic sphere.

5. The university must upgrade the system, website, software use, and policy documents as those are easily collectable and mostly offered by the open source authorities with minimum or no cost at all. Initiatives should be taken to implement Research Information Management (RIM) system, such as CRIS, which would enable the university to aggregate and monitor the research output.
6. Competent and sufficient staff must be employed in place, which must be convenient in Bangladesh because of its huge population and cheap labour, in order to run the operation of DIUR smoothly and to maintain efficient communication with both the authors, users and most importantly with the third parties like other IR, publishers, and other stakeholders with an aim to enrich the collection and providing seamless services.
7. A proper management of the DUIR is very crucial where amongst others one of the tasks of the manager could be ensuring mandatory collection of all the scholarly works from its associates by using efficient workforce, advertisement, encouragement, conducting seminars, and setting up hotline numbers to support to ensure that no intellectual publications stay behind unnoticed because of the lack of enquiry.
8. Procedural delays might be minimized by superseding the department and other authoritative permission and by rather enabling the authors themselves, if they like, to upload contents like any other modern user friendly websites, when the competent DUIR staff may keep the authority to do all the procedural work for the authors after uploading but prior to exposure before the readers. This should be a one stop service.

Limitations of the study

There are some possible limitations in this study due to the time constraint and limited access facilities to all the relevant information. Since the paper aims to highlight the significance of open access model in research work, the relevant literature on this area have been reviewed. However, although a number of studies have been conducted to find out the status as well as similarities and differences among institutional repositories within national and international

levels (Bhattacharjee and Sarmah, 2015; Dhanavandan and Tamizhchelvan, 2015; Hachani, 2017; Elahi and Islam, 2018; Sahu and Parabhoi, 2019), no research has been carried out so far focusing on two academic IRs situated in different countries. As a result, prior research studies particularly on this topic are limited. Next, the study highlighted the comparison between two institutional repositories of the City, University of London and the University of Dhaka following juxtaposing techniques. Nevertheless, data on users' experiences of these repositories have not been explored. As a result, future studies may be conducted from the perspective of the users' experience by surveying or interviewing them.

Conclusion

In this modern world of globalisation and technological advancement, the Open Access (OA) publishing model will be leading from the front and such demonstration has already been started and the pace of it is skyrocketing. Technological usage in various format is the key in the rapid expansion of OA model and one of the latest additions of such technological use is the emergence of Institutional Repository (IR). In the establishment of the fundamental human rights of access to knowledge, the OA model is second to none as by using this facilities people from the rural areas of the world are being able to communicate, have access to full text publications, and contribute to their own research papers completely free of cost. Academic institutions have taken the project of their IRs very seriously because it provides them with the opportunity to contribute with scholarly publications, flourish with intellectual strengths, uphold prestige of the institution, expose up their institutional influences, and so forth. The core advantages of the OA IRs like uninterrupted access to research publications, sustainable storing facilities of produced information, low cost but top-notch services etc. have made the OA model integral part of not only the academic life of the patrons but also the libraries themselves are greatly benefitted and dependent upon this as they can also collaborate among themselves to share such facilities. Therefore, the positive impacts of the OA IRs are no longer restricted to provide supports by facilitating with the access to electronic information resources easily, economically, and comprehensively to the present and future users by ensuring open access, open standards, and open sources, but rather its range of functioning have spread further to other libraries across the globe.

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Meeting and Un-meeting User's Needs and Expectations of Using E-resources of Dhaka University Library

Muhammad Jaber Hossain *
Md. Maidul Islam **

Abstract

Academic libraries need to be aware of the users' needs and expectations in order to improve the way they serve their users. They must render their services and facilities which are meaningful for the users instead of what is traditionally meaningful for the library. In this study, efforts have been made to analyze the meeting/un-meeting users' needs and expectations of using e-resources of Dhaka University Library. The Service Performance Control Matrix (SPCM) was used to explore the results. It was showed that all the service items are fallen into the improvement zone, which indicates users' minimum level of satisfaction is fulfilled. The result highlights the requirement for improvement of e-resource services. The study also evaluates the reasons why users are not using e-resources. Results reveal that despite the huge amount of e-resources availability, library's role in the usage of these resources does not play a significant role to fulfil its users' information needs and expectations. Finally, the paper proposes some recommendations to overcome the existing difficulties that made barrier for not using the e-resources as well as to ensure potential increase of using e-resources.

Keywords

User needs, User expectations, Meeting/un-meeting users' needs, E-resources, Dhaka University Library.

1. Introduction and Background

What is traditionally meaningful for the library is not necessarily meaningful for the library user. Libraries, therefore, must take initiative to ensure that the services offered are the services needed. Moreover, users' needs may change

* Professor, Department of Information Science and Library Management, University of Dhaka
** Assistant Professor, Department of Information Science and Library Management, University of Dhaka

over time and libraries must constantly take such changes into account. One of the biggest problems that strikes, whenever, we fail to meet our users' needs. So, no matter how good the service is, and no matter how well we support it, but everyone should keep in mind that when we do not deliver what users expect, they are unhappy (Rance, 2016).

The services that libraries provide continue to evolve with technology and user expectations. In a networked environment in an academic library e-resources are the most preferred resources for the teaching and research works (Bellary and Surve, 2019). The availability of electronic resources has allowed library users to find full-text resources from wherever they are searching, and library staff members have been able to repurpose space to encourage more collaboration. But managing e-resources poses challenges that libraries are still working to overcome.

As a service organization, an academic library wants to provide good service and improve its communication and engagement to support the growing expectations from the users. Therefore, the services deliver to users must not only keep pace but outperform these expectations. Smith (2011) stated use of collections and services is not only a reflection of how well they meet the mission and vision of the parent university, academic curriculum and the faculty research needs; it is also a result of how well-informed the user community is about specific resources offered by the library.

In recent years, several universities and research institutes in the country have started accessing electronic contents mostly through the Bangladesh INASP-PERii Consortium (BIPC) (Ahmed, 2013a). The University of Dhaka, established in 1921, is the oldest and largest public university in Bangladesh. On 1st July 1921, it opened its doors to the students with Sir P.J. Hartog as the first Vice-Chancellor of the University. The University started its activities with 3 Faculties, 12 Departments, 60 teachers, 877 students and 3 dormitories (Halls of Residence) for the students. At present the University consists of 13 Faculties, 83 Departments, 12 Institutes, 20 residential halls, 3 hostels and more than 56 Research Centres. The number of students and teachers has risen to about 37018 and 1992 respectively (DUAR, 2020). As the largest university in Bangladesh, Dhaka University Library (DUL) has the largest collections of

over 6,89,343 and 4,86,991full-text downloads (DUAR, 2019) covering all academic subjects except engineering and medicine. In this study, efforts have been made to analyze the meeting and un-meeting the expectations of the students, faculties, and researchers of the university on the use of existing e-resources.

2. Review of Literature

Understanding academic libraries requires understanding of higher education issues and needs (Hossain and Ahmed, 2013; Tiemensma, 2009). Therefore, higher education is recognized as a service industry, which emphasizes on meeting the expectations and needs of students (Hossain and Ahmed, 2013; Cheng and Tam, 1997). But, how can libraries further understand its end-users' needs and expectations and generating awareness of its e-resources to the information community (Profera and Shieh, 2013). In a study, Debbie A. Smith (2011) pointed out that a library's resources need to be marketed optimally to its end users in order to maximize ROI (Return on Investment). Taylor and Francis sought to explore the current library landscape is such that librarians have been given a significant but difficult quest meeting users' needs and expectations by expanding the collection of research data beyond traditional forms, such as: OPAC, databases, e-journals, e-books, institutional repositories, special collections, etc. (Profera and Shieh, 2013).

2.1 E-resources

Academic library is a part of any educational institution, which is the hub of the teaching, and learning activities where students, teacher and researchers get their required information according to their needs. For the traditional library perspective, users are respired to spend much more time for searching a small piece of information and for that they have to depend mainly on the library employees. But, in a networked environment e-resources can be used to supplement printed information in university libraries in order to give information seekers the choice to have access to more convenient and reliable information sources to meet their information needs (Ankrah and Atuase, 2018). It refers to those materials that require computer access, whether through a personal computer, mainframe, or handheld mobile device; they may either be accessed remotely via the internet or locally (Velmurugan, 2013). Deng (2010) considered e-resources as: e-databases, e-books, e-journals,

e-magazines), e-newspapers e-archives, e-theses, e-conference papers, e-government papers, e-monographs and e-research reports.

Whatever the sources or e-resources available in the library, the practical issue is whether the user community is using the appropriate sources? Are the users satisfied? Are the existing e-resources meet users' information needs or not? Are they even aware of the change in the existence of electronic resources? and so on. There has been series of studies like – "Measuring Dhaka University students' perceptions of ease of use and their satisfaction with University Library's online public access catalogue" conducted by Islam and Ahmed (2011); "Understanding perceived service quality and satisfaction: A study of Dhaka University Library, Bangladesh" by Hossain and Islam (2012); "Access and usage of electronic journals in Dhaka University Library (DUL): an empirical study", which was conducted by Islam, Alam and Sultana in 2011; "Use of electronic resources and its impact: a study of Dhaka University Library users" by Habiba and Chowdhury (2012); "Use of electronic resources by the faculty members in diverse public universities in Bangladesh" by Ahmed (2013)a. Ahmed (2013b) also conducted a study on "A survey of students' use of and satisfaction with university subscribed online resources in two specialized universities in a developing country", the purposes of which are to analyze the pattern of e-resources use by the students of two public universities in Bangladesh and to find out the problems faced by them in accessing these resources. In another study, entitled "The use of IT-based information services: An investigation into the current status of public university libraries in Bangladesh," Ahmed, 2014 focused on – to review the extent and capacity of IT-based library facilities utilized by public universities in Bangladesh, assess the existing IT infrastructure in the public universities, identify IT-related training needs by the university librarians, and so on. Like these so many studies were also conducted on different fields of interests. But no study still now shows that, are the existing e-resources of Dhaka University Library meeting/un-meeting the users' information needs and expectations? The present study is therefore conducted to fulfill the purpose.

2.2 Meeting and un-meeting users' needs and expectations

All businesses have the common goal of serving and satisfying their customers and satisfied customers are the best advocates of any type of organizations. So,

understanding customer needs and expectations; and taking initiative to meet those needs and expectations is a crucial importance of every type service organization. When customers use a service, they subconsciously go in with certain expectations and accordingly desire to meet those expectations. These expectations can also vary from user to user, and the true user satisfaction can only happen through a complete and proper understanding of their expectations. Unless the library knows what its users want, who they are and what they expect, it would be difficult to even match up to the expectations. Exceeding their expectations on a regular basis is the best way to satisfy them and retain their loyalty. If library provides excellent customer service at every opportunity, they are more likely to keep coming back.

The University of Dhaka allocated a huge amount of money (i.e. 26,85,350.00 Tk.) for online subscription for the academic session 2019-2020, of which 21,53,107 Tk. was allocated for BIPC Online Journal subscriptions, 3,38,427 Tk. for HeinOnline subscription, 78,306 Tk. for Remote Access subscription, 65,390 for Oxford Art Online subscription, and finally 50,120 Tk. was allocated for MAX Planck Encyclopedia of Comparative Constitutional Law (Dhaka University Library, 2019). Presently, the university library is providing online access to 16,807 indexed journals (as of 31 August 2021) to its users on different subject areas. The library professionals are providing user education/orientation to all faculty members and students every year to make aware of the subscribed online databases to the get return on investment. In this paper, an attempt has been made to show the existing situation of electronic resources in DUL, how DUL provides these electronic resources to the users, problems that are faced by DUL users while accessing electronic resources. Relevant suggestions and recommendations are also provided to improve the electronic resources and services for the benefit of users.

3. Objectives of the study

The specific objectives of the current research include-

i. To realize users' opinions with regard to meeting/un-meeting their needs and expectations over the types of sources and e-resources provided;

ii. To uncover the reasons for not using e-resources by the users; and

iii. To offer strategic directions on how to meet users' needs and expectations.

4. Methodology

4.1 Research framework and design

Graduate and undergraduate students of three faculties (e.g., Faculty of Arts, Faculty of Social Sciences, Faculty of Business Studies) of Dhaka University were studied utilizing a questionnaire survey. It also covers the status of use and reasons for not using e-resources by them. The quantitative part covers the respondents' opinions regarding e-resources based on their experiences, i.e., perception and expectations. To collect primary data structured questionnaire method was used. Respondents indicate their opinions in three column formats, e.g., desired service expectation (DE), minimum service expectation (ME), and perception of service performance (P) on a 7-point Likert-type scale. The data collected through the questionnaire were analyzed using SPSS. The SPCM model was applied to identify the meeting or un-meeting the user's needs and expectations for service items related to e-resources available in Dhaka University Library.

4.2 SPCM (Service Performance Control Matrix) model

The SPCM is an effective performance assessment model developed by Hossain and Ahmed (2013) to identify and evaluate the performance of service items and to establish the best strategy for improving service quality for academic libraries. The model consists of four major zones.

X = performance evaluation zone;

Y = study area zone;

Z = service strategy implementation zone;

A = zone of action or recommendation's zone;

Meeting and un-meeting users' expectations are measured in the 'X zone' (performance evaluation zone). This is categorized by four sub-zones, where each zone indicates a level of performance, and each level of performance is used as a performance indicator. These indicators are as follows: (P<ME), (P>=ME), (P>=RE), and (P>=DE).

4.3 How to measure meeting/un-meeting user's needs and expectation

To measure the meeting/un-meeting user's needs and expectations over existing e-resources of Dhaka University Library SPCM model is used, where the score of P, ME, DE (from respondents) and RE is compared. The result of comparison (P<ME) indicates "Need unmet", (P>=ME) indicates "Need met", (P>=RE) indicates "Expectation met", and (P>=DE) indicates "Expectation exceeded".

5. Analysis and Findings

5.1 Respondents' profile

Respondents' demographic information presented in Table-1 shows that the male respondents 210 (57.69%) formed the largest group in gender distribution, where the major proportion of students (273, 75%) is from undergraduate level.

Table 1: Respondents' status by gender

	Male		Female		Total	
Status	**n**	**%**	**N**	**%**	**n**	**%**
Graduate (MA)	58	15.93	33	9.07	91	25.00
Undergraduate (Hons.)	152	41.76	121	33.24	273	75.00
Total	210	(57.69)	154	(42.31)	364	(100.00)

5.2 Use and Frequency of using e-resources by gender

The proportional use of e-resources based on gender is described in Table-2. It explains that majority of respondents 69.78% (254 out of 364) are using e-resources in which male respondents (145, 39.84%) are forming the largest part in gender distribution. It also reveals that a good balance is observed between the ratio of graduate and undergraduate students' levels in terms of gender distribution. But unexpected situation is observed in terms of frequency of using e-resources in Table-3.

Table 2: Use of e-resources by gender

	Male		Female		Total	
Use of e-resources	**n**	**%**	**N**	**%**	**n**	**%**
Yes	145	39.84	109	29.95	254	69.78
No	65	17.86	45	12.36	110	30.22
Total	210	(57.69)	154	(42.31)	364	(100.00)

In Table-3, It is appeared that the largest number of respondents (135, 53.15%) is using e-resources only when they feel need "whenever I need", which is followed by (52, 20.47%) for "at least once a week". Very unfortunately, the lowest frequency is observed (at 23, 9.06%) in terms of "daily" use. This is of course a questionable fact that, for what reason(s) respondents were not using e-resources. The result of enquiry is presented in Table-4.

Table 3: Frequency of using e-resources by gender

	Male		Female		Total	
Frequency of using e-resources	**n**	**%**	**N**	**%**	**n**	**%**
Daily	12	4.72	11	4.33	23	**9.06**
2/3 days a week	29	11.42	15	5.91	44	17.32
At least once a week	26	10.24	26	10.24	52	20.47
Whenever I need	78	30.71	57	22.44	135	**53.15**
Total	145	(57.09)	109	(42.91)	254	(100.00)

5.3 Reasons for not using e-resources

Users were asked whether they are using e-resources. The answer (in Table-2) shows that 69.78% (254 out of 364) replied "Yes". Of the total 110 (30.22%) respondents who replied "No", who were further asked- why they don't use e-resources. In response to the query, they replied on multiple view points (shown in Table-4). It reveals that 65 respondents do not know how to use. It is followed by 59 respondents who are not

interested in using e-resources, and 49 persons feel that there are no available guidelines in using e-resources, 42 respondents do not use due to connectivity problems. In addition to these few of them (33) think that the existing webpage is not user-friendly for searching e-resources, and consequently 31 claimed that the information is not up-to-date. A number of respondents (30) also think that there is insufficient resources on their subject field, and only eight respondents do not show any reasons.

Table 4: Reasons for not using e-resources (Multiple responses)

	Male		Female		Total	
Reasons for not using e-resources	**n**	**%**	**N**	**%**	**n**	**%**
I do not know how to use	38	34.55	27	24.55	**65**	59.09
I am not interested	36	32.73	23	20.91	**59**	53.64
Not available guidelines	28	25.45	21	19.09	**49**	44.55
Connectivity problems	25	22.73	17	15.45	**42**	38.18
Searching e-resources through webpage is not user friendly	17	15.45	16	14.55	**33**	30.00
Not up-to-date information	18	16.36	13	11.82	**31**	28.18
Insufficient e-resources on my coursework	20	18.18	10	9.09	**30**	27.27
Others	3	2.73	5	4.55	**8**	7.27

Whatever the reasons for not using e-resources by the respondents of DUL, a rational question is arisen that, are the existing e-resources of DUL met the users' needs or not. To explore the perspective, an inquiry was taken from the respondents, which is shown in Table-5.

5.3 Identifying Meeting and Un-meeting users' needs

To identify the score of meeting and un-meeting users' needs, respondents' opinions on desired service expectations, minimum service expectation and perception of service performance are presented (in Table-5) in the form of mean and standard deviation (SD) scores. The derived construct Real service expectation is also presented.

Table 5: Mean and SD of types of sources, e-resources use and personal assessment

Item no.		Desired Service Expectation (DE)		Minimum Service Expectation (ME)		Perception (P)		Real Service Expectation (RE)
	Types of sources	Mean	SD	Mean	SD	Mean	SD	RE = (DE+ME)/2
01	Online catalogue	6.22	0.73	3.68	0.94	4.15	1.02	4.95
02	Full text database	6.17	0.74	3.33	1.01	3.88	1.04	4.75
03	Web sites	6.12	0.81	3.70	1.07	4.08	1.12	4.91
04	Institutional repository	6.07	0.75	3.37	0.97	3.82	1.00	4.72
05	Ask a librarian	6.11	0.73	3.37	1.03	3.77	1.07	4.74
06	Library Facebook page	6.13	0.83	3.43	1.09	3.93	1.11	4.78
	Types of e-resources use							
07	E-journals	6.05	0.79	3.59	1.09	3.90	1.15	4.82
08	E-books	6.09	0.87	3.71	1.10	4.00	1.20	4.90
09	E-theses/dissertations	6.16	0.68	3.17	0.79	3.71	0.93	4.67
10	CD-ROM	5.97	0.78	3.15	0.90	3.65	0.92	4.56
	Factors							
11	Sufficient number of e-resources on my subject	6.09	0.84	3.61	1.12	3.91	1.22	4.85
12	E-resources are appropriate for my course work	6.07	0.88	3.57	1.06	3.87	1.09	4.82
13	E-resources are up to date	6.12	0.87	3.58	1.14	3.80	1.15	4.85
14	Available connectivity to e-resources	6.04	0.91	3.40	1.09	3.75	1.20	4.72
15	Available guidelines to use e-resources	6.06	0.82	3.44	1.11	3.70	1.21	4.75
16	Easy to access to e-resources	6.06	0.90	3.57	1.13	4.07	1.16	4.82
17	Easy to search and retrieve e-resources from library websites	6.05	0.86	3.46	1.11	3.88	1.19	4.76

To evaluate the existing service performance as well as to identify the meeting and un-meeting users' needs and expectations on using e-resources the concerned items (from Table-5) are mapped onto the SPCM model based on their degree of comparison between the constructs P<ME or P>=ME or P>=RE or P>=DE (see Figure-1).

		Performance evaluation zone (*X*)					
		Problematic zone (X_1)	**Improvement zone (X_2)**	**Maintain zone (X_3)**	**Excellent zone (X_4)**		
		(*P<ME*) Need unmet	(*P> = ME*) Need met	(*P> = RE*) Expectation met	(*P> = DE*) Expectation exceeded		
Study area zone (*Y*)	Types of Sources	No Items	**All Items (01 – 06)**	No Items	No Items	*A_1	**Zone of action (*A*)**
	Types of E-resources	No Items	**All Items (07 – 10)**	No Items	No Items	*A_2	
	Factors	No Items	**All Items (11 – 17)**	No Items	No Items	*A_3	
		Prompt action to recovery of service performance	**Seeking Improvement of service performance**	**Maintain service performance strictly**	**Maintain service performance as it was**		
		Service strategyimplementation zone (*Z*)					

Figure 1: Identifying meeting and un-meeting users' needs and expectations using SPCM model (Source: Hossain and Ahmed, 2013)

The result of SPCM from Figure-1 is finally clarified in Table-6. It presents which item meets user's needs and expectations and which item not.

Fortunately, all the items are fallen into the improvement zone. It indicates that users' expectations for e-resources met at minimum level, which requires improvement of service performance. The result is closely relevant to an earlier research conducted by Habiba and Chowdhury (2012), which revealed that e-resources are used for learning purpose by majority of the users of DUL and users are generally satisfied with these materials.

Table 6: Results of SPCM on Meeting/Un-meeting users' needs and expectations for service performance

Code #	Statement	(*P*<*ME*)	(*P*> = *ME*)	(*P*> = *RE*)	(*P*> = *DE*)
		Need unmet	Need met	Expectation met	Expectation exceeded
Item no.	**Types of sources**				
01	Online catalogue	x	Met	x	x
02	Full text database	x	Met	x	x
03	Web sites	x	Met	x	x
04	Institutional repository	x	Met	x	x
05	Ask a librarian	x	Met	x	x
06	Library Face book page	x	Met	x	x
Item no.	**Types of e-resources use**				
07	E-journals	x	Met	x	x
08	E-books	x	Met	x	x
09	E-theses/dissertations	x	Met	x	x
10	CD-ROM	x	Met	x	x
Item no.	**Factors**				
11	Sufficient number of e-resources on my subject	x	Met	x	x
12	E-resources are appropriate for my course work	x	Met	x	x
13	E-resources are up to date	x	Met	x	x
14	Available connectivity to e-resources	x	Met	x	x
15	Available guidelines to use e-resources	x	Met	x	x
16	Easy to access to e-resources	x	Met	x	x
17	Easy to search and retrieve e-resources from library websites	x	Met	x	x

6. Discussion

The study investigated the assessment of meeting and un-meeting users' needs and expectations of using e-resources of Dhaka University Library. The Service Performance Control Matrix (SPCM) method was used for this assessment purpose. For doing so, the study used primary data gathered from the students of three faculties of Dhaka University namely- Faculty of Arts, Faculty of Social Science, and Faculty of Business Studies. A structured questionnaire using three column formats on a 7-point Likert-type scale was used for primary data collection. The result of users' opinions regarding meeting and un-meeting their needs and expectations for library's e-resources were explored. It shows all the service items fulfilled users' minimum level of needs. Moreover, meeting users' minimum information needs does not indicate the meeting of their expectations. Because users' expectations for services are fluctuating between a certain range, even sometimes it may exceed this range. So, despite the findings, the overall result is not quite satisfactory and requires further improvement of service performance. Librarians, therefore, should take proper strategic directions for the future improvement of e-resource services.

The study also explained why users are not using the e-resources. With regard to this fact the Table-4 explained that majority of respondents (59.09%) replied they do not know how to use the e-resources, 53.64% users indicated- they were not interested in using e-resource, and of the total 44.55% said- there is no available guidelines for using e-resources. This indicates the university library do not pay much attention toward the usage levels of its existing e-resources, rather it paid attention to collect vast number of e-resources. In an earlier study, Ahmed (2013b) accordingly claimed that many students do not use university subscribed e-resources. However, the result also shows that 38.18% opined the connectivity problems, while 30.00% indicated- the webpage for searching e-resources is not user friendly. In addition, 28.18% users did not use e-resources, as they think there is no up-to-date information. Finally, 27.27% users said- there are insufficient e-resources on their course work, and 7.27% did not indicate any specific reason for not using the e-resources.

Results also revealed that, although the Dhaka University Library provides access to scholarly literature through large collections of e-resources by means of various databases, e-books, e-journals and electronic theses and

dissertations; but this effort did not play significant role to fulfil its users' information needs and expectations due to some sorts of limitations. The Library, therefore, should take initiative to ensure and regular monitor that what is available can be accessed and is used to the best effect to its users.

7. Recommendations

To address the deficiencies regarding the use of e-resources of Dhaka University Library the study proposes a number of recommendations.

7.1 Raising awareness about e-resources

The study shows that a large number of students don't know how to retrieve and use e-resources, and likely significant numbers are also not interested to the use of e-resources. This situation is consistent with the Ahmed's (2013b) study, who suggested that it is important to teach and encourage the students more so as to increase their appreciation for such resources. It is also a recognized fact that most of the students in Dhaka University rely on books and handouts (Islam, Alam and Sultana, 2011). The faculty members can encourage students in the class room for promoting the use of e-resources among the students to keep them up-to-date.

7.2 Service orientation and user education

The library can arrange service orientation and user education programs regularly to enhance the usage of subscribed e-resources. In an earlier study, Bellary and Surve (2019) showed that the orientation programme bridges the gaps between users and existing library resources.

7.3 Organizing training or workshop

Library authority can occasionally organize short-term training or workshop for its stakeholders in order to improve and promote the usage level of its e-resources. In a study, Tlakula (2016) analysed the usage of e-resources at the University of Venda by the student community and found that usage is very low. To enhance the usage of e-resources he therefore suggested for training and library orientation. Ahmed (2013b) accordingly mentioned, students can be encouraged to use digital resources more often through regular training and practices.

7.4 Internet-based infrastructural improvement

To promote the use of e-resources by the students, infrastructure improvement in terms of increasing the number of public access computers at different places (i.e., at library's front desk, departmental computer lab and class rooms, residential halls, students' common rooms, etc.), improving internet connectivity and bandwidth, and more particularly campus-wide wifi connectivity and terminals should be installed.

7.5 Library website adaptation

A significant number of the respondents claimed that library webpage is not user friendly for searching e-resources. Actually, the rate of growth in the amount of information available in the web has not been followed by similar advances in the way this information is organized and exploited. Web adaptation, therefore, seeks to address this issue by transforming the topology of a website to help users in their browsing tasks. It is the process of facilitating ease of interaction, quick discovery of information (Brusilovsky, 2004), adjusting web-based systems to accommodate user diversity (Brusilovsky, 2004 and Paternò and Mancini, 2000) and 'individualization' of solutions as opposed to the "one-size-fits-all" approach (Peißner, Janssen and Sellner, 2012). Knutov, De Bra and Pechenizkiy (2009) accordingly indicate the adaptation as content, presentation and navigation adaptation. The Semantic Web is an ambitious initiative aiming to transform the web to a well-organized source of information. This will enhance the way we search the Web. So, the user interface needs to be adapted to the user's device to provide a good user experience and responsive layouts, where the user interface automatically adjusts itself to the user's device.

7.6 Establishing marketing plan and e-resource publicity

There is a popular argument posed by Dillon (2002) that library users today often confuse free information on the web with subscription resources that the library purchases. Libraries now have to make a case for their resources and need to demonstrate to patrons how these tools fit into the bigger picture of our digital society. Dillon also stated that a library-wide digital marketing plan needs to be in place before promotion of specific resources can be achieved. A number of marketing initiatives specially to publicize the existing e-resources

in different forms of publicity like- contents circulation, occasional campaign, installing campus television and e-resources exhibition, etc. can also be taken into consideration to productive use of e-resources.

7.7 Giving priority of users' current need

Among the respondents 28.18% claimed for not up-dated resources and 27.27% claimed for insufficient e-resources. The authority, therefore, should pay more attention to users' intention regarding the use of e-resources to fulfils their information needs as much as possible. The authority also must subscribe sufficient up-to-date resources on the users' fields of interests. In addition, when users arrive at their desired information sources via online, they expect consistent quality of service on every channel. It means that library authority needs to work harder than ever to ensure the online experiences they provide meet the standards expected by the users.

7.8 Establishing user communication and engagement

An effective library services delivered to users must not only keep pace but outperform the users' needs and expectations. So, if the library authority thinks about the achievement of high-level user service scores, they should ensure user communication and engagement with the existing mode of service delivery. It will obviously control and support the growing expectations of the users, meet users' potential needs and also deliver greater benefits by creating a user-focused service solution.

7.9 Development of IT-based frontline service desk

Development of an effective workforce is an important part of delivering a competent customer service operation. Moreover, delivering a great service to the users, explaining why library cannot do things is not good enough. What the most effective IT service management organizations do is to take responsibility for managing users' expectations. So, in order to improve the ability to meet users' expectations reliably, library authority need to do four additional things (Rance, 2016):

- Understand what users expect;
- Communicate what can be achieved and try to influence users' expectations;

- Manage the services to deliver what users expect;
- Report the achievements to ensure that users know what library delivered.

All four of these are important, and library is most likely to meet its users' expectations only if the concerned authority pays close attention to all of them.

If the proposed recommendations set out above are considered by Dhaka University Library authority, it will give a pathway for the library to the development for the productive use of e-resources and services by its users.

8. Conclusion

The main purpose of this study was to analyze users' opinions with regard to meeting/un-meeting their needs and expectations for e-resources. Result shows that, the users' expectations for the number of service items met at a minimum level that is not quite satisfactory to them. A number of reasons for not using the e-resources were also evaluated by the users. Finally, the study provides some significant directions to bridge the gaps between users' expectations for e-resources and the existing reality. It is, therefore hoped that, this paper will encourage concerned library authority to emphasize on the fulfilment of users' needs rather than collections.

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Translations in Bengali, as Depicted through Indian National Bibliography: A Study

Swarup Roy *
Swapna Banerjee **
Aditi Das ***

Abstract

The importance of translations in today's literary world is increasing day by day. In this context, the translated works in a National Bibliography of a country is very important. The translated works in Bengali in the Indian National Bibliography has been dealt with in this article. India is a country of varied heritage, cultural and linguistic confluence. So, the Indian National Bibliography is also a repository of literary works of multidimensional value. The aim of this article is to bring into limelight the literary works of different languages which have been translated into Bengali from 2016-2019, and which have been incorporated in the Indian National Bibliography. The objective of the study is to highlight the status of translated works, especially in Bengali language in INB. Since this is a maiden work, therefore, this will be valuable to the academicians, researchers and librarians. The findings of this study have been depicted in various ways, quantitatively and qualitatively i.e., year wise number of translators, number of authors, types of languages from which translations have been done, number and types of publishers, etc. The conclusions drawn from the study shows the trends and patterns of translated works in Bengali in INB. Trends of these works belonging to different classes of DDC have been emphasized. Much more amount of work need to be done in this important aspect in future.

Keywords

National Bibliographical Control, publishing house, speech, letter, literary forms.

1. Introduction

Translated works are increasingly being viewed as potent means of developing bridges across geographical and linguistic spaces. In India, the translation of literary works into various languages, including English, is attracting the

* Librarian, Mount Zee Litera School, Kolkata
** Professor, Department of Library and Information Science, University of Calcutta
*** Senior Research Fellow, University of Calcutta

energy of many translators, academicians, and students. The key points pertaining to the importance of translation in our everyday life are translations could contribute to keeping worldwide order, translation is essential for spreading world wide information, translation is essential when it comes to exchanging cultural issues, translation is a form of job and translation can test human faith and religion.

National bibliography is a sequential record of the nation's publishing output. It also plays an important role in National Bibliographic Control. A current national bibliography reflects the culture of a country. The uniqueness of a country is to be learnt by looking at the current national bibliography. The strength on agriculture and technology, the make-up of its general public through its different language distributions, specific traditions and services significant in the life of the country, the significance of education, literature, and science, prominent artistic writers of the time and religious, political and social patterns inside a nation are on the whole discernible. A national bibliography can be a source of data about a country's publishing output for official statistics.(1)

Indian National Bibliography is unique when compared with other national bibliographies since 14 languages come under one umbrella . There is a need to recognize the translated work in INB, 2016-2019 in the field of Bengali language. Since no study have been carried out so far relating to translated works in INB, therefore, there is need to carry out this type of work, especially when information explosion of literary works has reached its peak. Researchers, academicians and librarians need to be informed about the quantity and quality of translated works, to proceed systematically in their research. Focus has been especially given on Indian National Bibliography, since it is the main national repository of literary works. The paper will focus primarily on the detailed study of eminent work and also the writers of different languages whose works are being translated into Bengali.

2. Review of the literature

Chakrabarti (2015) in his thesis, "Bangla Translations of the Shrimad Bhagavad Gita in the Early Twentieth Century" describes the religious belief, understanding of philosophy, ideology, cultural background, political

affiliation and inclination along with the contemporary social and political scenario of Bengal on the early twentieth century, through the translations of the Shrimad Bhagavad Gita.

Mondal and Maity (2019), in an article presents an analytical study of the pattern of the receipt of books by the National Library, under the Legal provisions of DB Act, 1954 in the discipline of Library and Information Science during 2010-2017.They reported an overall fluctuating trend in the appearance of bookjs in the INB volumes.

Bashir and Khanum (2021), discusses the role of publishing houses in Pakistan to reach the readers, and especially their role in language and linguistics. It also portrays some study of Pakistan National Bibliography in particular.

Suryakant (2016) in "Documenting Translation Process Towards Creating a Multi-Media Corpus" at Department of Translation, The English and Foreign Languages University, Hyderabad, examines the possibility to prepare a suggestive model of a corpus that suits and fulfils the needs of the process of researchers, and discusses various standard practices of data elicitation involved in the translation process research.

Adiga (2017) in his thesis, "Tracing the Translation Process through Translation Versions" at the Department of Translation, The English and Foreign Languages University, Hyderabad, examined various drafts or versions of translations produced by the translator during the act of translation over a period of time. These versions of translation are nothing but a series of drafts produced by the translator while translating a literary text. In the process of translation, various versions have been produced by the translator as the modifications/deletions/additions were carried out.

Akan, Islam and Ahmad (2020) in their article "An Insight into the Intricacies of English to Bangla Translation" depicted the different methods of translation, analyses the problems arrives in translating the documents in Bengali such as syntactic problems, semantic problems, stylistic problems and phonological problems. They also put some suggestions for English – Bangla translation. Lastly, they discusses the roles that translators can play.

3. Objectives

a. To find out the number of books translated in Bengali from 2016-2019
b. To find out the number of publishers who published translated books in Bengali.
c. To find out the number of translators who translated books in different languages to Bengali.
d. To find out the different languages from which the Bengali translations has been done.
e. To find out the different forms of literature on which the translation has done.
f. To find out the different classes of DDC to which translated books belong.

4. Methodology

INB is being published by Central Reference Library, Kolkata. Thus, the authentic data can only be found in Central Reference Library itself. The study employed is a case study approach and it has been done in two ways. The main method employed in data collection is survey and also historical method of data collection.

a. Online study: From 2013 the data have been published on the official website of the Central Reference Library, Language bibliography section. The data of 2016 and 2017 have been collected from their official website.
b. Physical study: Due to some technical issues the data of 2018 and 2019 has not been published yet in their website. Therefore the data of 2018 and 2019 has been collected from hardcopy available at Central Reference Library.

5. INB: At a Glance

In 1955, the then Ministry of Education appointed a committee of the Indian National Bibliography consisting of seven members headed by late B.S. Kesavan, the first Librarian, National Library of Independent India, Calcutta to make initial plans for a National Bibliography. The committee laid down general structure and the principles for governing the compilation of Indian National Bibliography. They are concerned with the coverage, script, classification, cataloguing, periodicity etc. The INB unit started functioning from August 1955 in the premises of National Library Kolkata. In 1970, CRL

started to function as a separate subordinate office of the Department of Culture, Govt. of India, headed by a fullfledged Librarian.

The aim of INB is to publish an accurate and comprehensive bibliographical records of current Indian publications in major fourteen Indian languages of India [Assamese, Bengali, English, Gujarati, Hindi, Kannada, Malayalam, Marathi, Oriya, Punjabi, Sanskrit, Tamil, Telugu and Urdu] received at the National Library, Kolkata under the provisions of the Delivery of Book [public libraries] Act, 1954.

The first volume of the INB appeared as quarterly with annual cumulations from 1958 to 1963, and its periodicity was changed to monthly in 1964 and continued up to 1977. After a few years, it became irregular. Only annual volumes were published during 1978 and 1979. 1980-81 was published as cumulative volumes in two parts. Since January 1984, the 4 periodicity of this publication became monthly. This continued till 1993. Again from 1994, monthlies could not be published. June 2000 is the landmark in the history of Indian National Bibliography when its compilation was completely computerized. Up to today, all the monthly issues are being published regularly.

Influenced by Paris Conference of UNESCO in 1950, Government of India took serious initiatives for the development of the bibliographic services. The Government of India enacted the Delivery of Books [Public Libraries] Act, in 1954. The Act made it obligatory for the publishers in India to deposit a copy of each book published to the National Library, Calcutta (now Kolkata) and three other public libraries. The three other public libraries are Connemara Public Library, Madras (now Chennai), Central Library, Bombay (Now Mumbai) and Delhi Public Library, New Delhi. The publishers are supposed to send their copy of publication to these libraries within thirty days from the issue of the publication at their own expenses. The copy deposited in the National Library is passed on to the Central Reference Library, Kolkata for the compilation of the Indian National Bibliography. The Act was amended in the year 1956 so as to include Periodicals and Newspapers. This Act was a step forward in the direction of bibliographic control of Indian publications. It made it possible to plan the compilation of a

comprehensive National Bibliography in thirteen Indian languages, recognized by the Indian Constitution, and English.

National bibliography is a sequential record of the nation's publishing output. It also plays an important role in National Bibliographic Control. It is produced by the national bibliographic agency in accordance with international standards. A current national bibliography reflects the culture of a country. The uniqueness of a country is to be learnt by looking at the current national bibliography. The strength on agriculture and technology, the make-up of its general public through its different language distributions, specific traditions and services significant in the life of the country, the significance of education, literature, and science, prominent artistic writers of the time and religious, political and social patterns inside a nation are on the whole discernible. Unique characteristics of a country can be reflected by the current national bibliography. It ought to incorporate sections of books within one year of their publication. India is a multi-cultural, multi-religious, and multilingual nation where semantic variety is a part of the chronicled social legacy and a fundamental part of country building philosophy. 29 languages are spoken by more than a million native speakers and 122 languages by more than 10,000. These are classified, belonging to four distinct linguistic families: Indo-Aryan, Dravidian, Tibeto-Burman, and AustroAsiatic, all of which have some tribal speech communities. 22 languages are listed under the 8th schedule of the Indian constitution [which includes two tribal languages-Santali and Bodo. The scripts of South and Southeast Asia have many structural similarities: most are phonetic, most are written from left to right, most use spaces or marks between phrases, and so on. Most of these scripts are derived from the ancient Brahmi script. Urdu, Sindhi, and Kashmiri are usually written in PersoArabic scripts. Sometimes they are written in Devanagari also. Apart from Perso-Arabic scripts, the remaining ten scripts have evolved from the ancient Brahmi script, and have a common phonetic structure, which allows a common character set among these scripts. 15 Indian National Bibliography (INB) reflects the social legacy of our nation. In this information-based society, INB has a significant role to carry out. The types of publications, publishing process, as a rule, the arrangement of national bibliographies from the printed variant to CD ROM, and online adaptations have a lot changed the extent of the national bibliography.

6. Findings

This study brings into limelight the various results obtained from the study of the literary works of translations covered in the INB related to Bengali literature from 2016-2019.

Table 1 shows the distribution of translated books, according to the DDC classification number from 2016-2019. A maximum number of translated works lies in 800 class and a minimum number of translated works lies in 400, 500, and 600 classes, respectively. More than 50% of translated works is found in 800 Class. There was only one entry in 600 Class in the year 2016. In 2018 also there was only one entry each of 400 Class and 500 Class respectively.

DDC CLASS	2016	2017	2018	2019
000 Computer science, information, general work	0	1	1	1
100 Philosophy, parapsychology and occultism, psychology	6	3	0	3
200 Religion	24	13	20	13
300 Social Science	16	3	6	12
400 Language	0	0	1	0
500 Pure Science	0	0	1	1
600 Technology	1	0	0	0
700 Art & Recreation	0	2	2	1
800 Literature	63	38	45	87
900 History & Geography	25	6	15	12

Table 1: DDC Classification number wise distribution of translated books

Table 2 depicts the number of total Bengali books and translated (into Bengali) books in INB yearly from 2016-2019. In the year 2019, the highest number (2795) of books in Bengali which have been published has been included in INB, and in the year 2018, the lowest number (1978) of books have been published in Bengali have been included. A total o 2766 and 2414 published books in Bengali have been included in 2017 and 2018, respectively, as depicted in Indian National Bibliography. The highest number of translated books had been entered during the year 2016 (i.e. 4.84%), and, the least number of translated books in Bengali have been entered in 2017 (i.e. 2.73%).

BOOKS	2016	2017	2018	2019
TOTAL	2766	2414	1978	2795
TRANSLATED	134 (4.84%)	66 (2.73%)	91 (4.60%)	130 (4.65%)

Table 2: Total Number of Bengali books and Translated (into Bengali) books in INB (Year wise)

Table 3 depicts the number of publishers according to the year of publication of the translated books. From this table, it is found that in the year 2016, the numbers of publishers were maximum (86), which was almost double compared to the other three years. The lowest numbers of publishers was in the year 2017 (46).

YEAR	NO OF PUBLISHER
2016	86
2017	46
2018	49
2019	48

Table 3: No. of Publishers of translated books (2016-2019)

Table 4 shows the number of translated books published by a publisher. There were a lot of publishing houses that published one translated book in a particular year. In 2016, there were 69 publishers who published only one translated book. While in 2017, the number of publishers were 35 and in 2018 and 2019 the number was 33 and 25, respectively. Both in 2016 and 2019 there were 3 publishing houses who published more than 4 books but in 2017, no such record could be found.

No. of book/books	2016	2017	2018	2019
1 book	69	35	33	25
2 books	10	4	7	13
3 books	3	5	5	5
4 books	1	2	2	2
more than 4 books	3	0	2	3

Table 4: No of translated books published by no. of Publishers.

Table 5 describes the number of translators' year wise, from 2016 to 2019, who translated works in Bengali. In the year 2016, the highest number (125) of translators' works have been depicted in Bengali in Indian National Bibliography, and the lowest number was in the year 2017. There were 85 translators mentioned in the Indian National Bibliography, (Bengali) in 2018, while, the number of translators in the year 2019 were 112.

YEA R	NO OF TRANSLATORS
2016	125
2017	68
2018	85
2019	112

Table 5: Number of Translators year wise

Table 6 shows the number of book/ books translated by a translator. In the year 2016, there were 113 translators who translated only one book, 8 translators who translated two books, 3 books were translated by 3 translators and there was only one translator who translated more than 4 books in 2016. Similarly, there were 66 translators who translated only 1 book in 2017. In 2018 and 2019 the number of translators who published only 1 book was 75 and 93, respectively. None of the translators translated more than 4 books in 2017, 2018, and 2019.

No. of book/books	2016	2017	2018	2019
1 book	113	66	75	93
2 books	8	2	8	13
3 books	3	0	2	5
4 books	0	0	0	1
more than 4 books	1	0	0	0

Table 6: No of book/ books translated by translator

Table 7 describes the translation according to language. In 2016, a total of 134 books had been translated- among these, 49 books were of Indian languages, and 85 were of foreign languages. In 2017, 19 books were of Indian languages and 49 were of foreign languages. 37 books were translated in Bengali from other Indian languages, and, 54 books were translated in Bengali from foreign languages in 2018. In 2019, out of 130 books, 62 books were from Indian languages and 68 books were from foreign languages which were translated into Bengali language. The percentage calculation has also been done on the basis of year wise total number of books translated from Indian and foreign languages.

Year	Indian language	Percentage	Foreign language	Percentage
2016	49	36.5	85	63.4
2017	19	28.7	47	71.2
2018	37	40.6	54	59.3
2019	62	47.7	68	52.3

Table 7: Language wise Translation

Table 8 illustrates the translations into Bengali from various foreign languages. There were 18 foreign languages from which works were translated into Bengali. Among them, the maximum numbers of books were in English language. In 2016, there were 50 books that were translated from English to Bengali. Consecutively, 35, 33, and 36 English books were translated into Bengali in 2017, 2018, and 2019. Other than English there were several foreign languages like German, Spanish, Portuguese, Greek, Armenian, Russian, Ukrainian, Dutch, Swedish, Chinese, Tibetan, Italian, Polish, Japanese, and French, etc. from which literary works have been translated. The percentage calculation has been done on the basis of year-wise total number of books translated into Bengali from foreign language.

LANGUAGE	2016	%	2017	%	2018	%	2019	%
ENG	50	58.8	35	70	33	61.1	36	53.7
JAP	2	2.3	1	2	3	5.5	2	2.9
GER	6	7.0	3	6	1	1.8	3	4.4
TUR	1	1.1	0	0	0	0	1	1.4
FRA	8	9.4	0	0	7	12.9	3	4.4
SPA	10	11.7	1	2	3	5.5	7	10.4
POR	2	2.3	2	4	1	1.8	2	2.9
GRE	2	2.3	3	6	1	18	1	1.4
PER	1	1.1	1	2	1	1.8	1	1.4

Table 8: Translation into Bengali from Foreign languages

JAP=JapaneseGER=German,TUR=Turkish,FRA=French,SPA=Spanish,POR =Portugese,GRE=Greek,PER=Persian,RUS=Russian,ARM=Armenian,UKR= Ukranian,DUT=Dutc

Table 9 show the translations into Bengali from other Indian languages. There were 18 Indian languages from which works were translated into Bengali. Among them, maximum books were translated from Sanskrit and Urdu languages. Other than Sanskrit and Urdu, there were several languages like Hindi, Santali, Telugu, Nepali, Punjabi, Meitei, Kannada, Gujarati, Lepcha, Maithili, Tamil, Marathi, Rajasthani, Assamese, Odia, and Pali, etc. The percentage is done on the basis of year wise total number of books translated into Bengali from Indian languages.

RUS	1	1.1	1	2	1	1.8	4	5.9
ARM	2	2.3	0	0	0	0	2	2.9
UKR	0	0	1	2	0	0	0	0
DUT	0	0	1	2	0	0	0	0
SWE	0	0	1	2	0	0	0	0
CHI	0	0	0	0	0	0	2	2.9
TIB	0	0	0	0	0	0	2	2.9
ITA	0	0	0	0	2	3.7	1	1.4
POL	0	0	0	0	1	1.8	0	0

Table 9: Translations into Bengali from Indian languages

Table 10 depicts the geographical area of publishers. Those areas are mainly divided into two broad categories- the first one is Kolkata, and the next depicts the publishers from places other than Kolkata. The INB includes many publishers for translated works, but in this table, a few of them are mentioned, especially those who have published translated works every year and whose works have been included in INB from 2016-2019. Among them, 10 publishers belong to Kolkata and 5 publishers are other than Kolkata.

LANGUAGE	2016	%	2017	%	2018	%	2019	%
SANS	12	25	2	10.5	6	27.2	13	20.9
URDU	10	20.8	3	15.7	3	13.6	6	9.6
PALI	6	12.5	3	15.7	2	9	0	0
HIN	8	16.6	2	10.5	1	4.5	10	16.1
SAN	1	2	0	0	0	0	1	1.6
ASS	0	0	2	10.5	5	22.7	7	11.2
TEL	3	6.2	0	0	2	9	1	1.6
NEP	1	2	1	5.2	0	0	2	3.2
PUN	1	2	0	0	1	4.5	3	4.8
ODIA	3	6.2	4	21	1	4.5	7	11.2
MEI	1	2	1	5.2	0	0	2	3.2
KAN	2	4.1	0	0	0	0	1	1.6
GUJ	0	0	1	5.2	1	4.5	0	0
LEP	0	0	0	0	0	0	1	1.6
MAI	0	0	0	0	0	0	3	4.8
TAM	0	0	0	0	0	0	1	1.6
MAR	0	0	0	0	0	0	3	4.8
RAJ	0	0	0	0	0	0	1	1.6

SL NO.	KOLKATA	SL NO.	OUTSIDE OF KOLKATA
1.	Mahabodhi Book Agency	**1.**	Sahitya Academy
2.	Ebong Museyera	**2.**	Westland
3.	Ananda	**3.**	Oxford
4.	Ramakrishna Mission Institute of Culture	**4.**	Athena Books
5.	Patrabharati	**5.**	Sristisukh
6.	Pratibhas		
7.	Akhshar Publication		
8.	Dhansiri		
9.	National Book Agency		
10.	Adi Mallick Brothers		

Table 10: Geographical areas of Publishers

Table 11 describes the various forms of translations in 2016. In the year 2016, four types of forms are found, they are - poetry, drama, fiction and letter. Among them, the number of fiction is maximum, that is, 31 and the minimum number is 1, which is letter. The number of drama and poetry are 12 and 19 respectively.

FORM	2016
POETRY	19
DRAMA	12
FICTION	31
LETTER	1

Table 11: Translations (various forms)- 2016

Table 12 shows the different forms in the year 2017. Here we get a total of 6 types of forms- among them, the numbers of fictions are maximum, that is 19, and the number of speech and letter form is minimum, that is 1 each. The number of poetry and drama are 9 and 6 respectively.

Table 12: Translation (various forms)- 2017

FORM	2017
POETRY	9
DRAMA	6
FICTION	19
SPEECH	1
LETTER	1
LITERATURE	2

Table 13 describes different forms of translation of the year 2018. In this year, 3 types of forms are found in literature class- they are poetry drama and fiction. Among them, the numbers of fictions are maximum, that is 22 and the number of drama is minimum, which are 3. This year the numbers of poetry forms are 19.

Table 13: Translation (various forms)- 2018

FORM	2018
POETRY	19
DRAMA	3
FICTION	22

Table 14 shows 3 types of forms; among them the numbers of fiction are maximum, that is 44, and the number of dramas are only 5. We also get 31 forms of poetry this year.

FORM	2019
POETRY	31
DRAMA	5
FICTION	44

Table 14: Translation (various forms)- 2019

7. Analysis

Many facts have been revealed in this study regarding Bengali translations. It is seen that maximum number of translations done in Bengali literature was from English language, but a lot of translated work had been done from languages also like- Hindi, Urdu, German, and Spanish, etc. Most of the translated works fall in the literature class, followed by , class of Religion of DDC. Among them, most of the books represent Hinduism and Buddhism. Thus we can say that the translations of Vedanta philosophy in Hinduism and works in Buddhist philosophy are in trend of translations. Surprisingly, numbers of translated works were minimum in Language (400)class, Science (500) class, and Technology (600) classes of DDC.

There is a big gap between the total number of Bengali books in INB, and the number of translated books , as revealed from the study of the span 2016-2019. In each year, the number of the translated books was always less than 5%, which means the persons having no knowledge of English or any other language other than Bengali will never have the opportunity to gather the information published in other languages.

It is saddening to see that from 2017-2019, the number of publishers became half of that of the year 2016. Since 2016, the number of publishers for translated books has been continuously decreasing, which is really an astounding matter. The reason behind it may be that the publishers are no more interested to publish translated books, because they are actually finding fewer readers of the previously published translations. According to the findings, it can be said the work of translation is limited to only a few publishers, and a large amount of translation work is not being done by many translators.

The number of translators was highest in the year 2016. After that, there was a gradual decrease in the number of translators, but in 2019 it again increased. In this virtual era, translation is very important, thus it is really good to see that the numbers of translators have increased from 2019. Even Pulitzer Prize, Man Booker Prize, Sahitya Academy award are really good inspiration for the translators. More than 85% of the translators are the ones who translated only one book. But the number of translators who translated 4 books and more

is only two, which proves that translators have been giving importance to the quality of books rather than quantity of books.

18 different foreign languages are found in the Indian National Bibliography from which books have been translated into Bengali during 2016-2019. Among all the foreign translations work, maximum translation is done into Bengali from the English language. Many works of literature from Spanish, French, German languages are translated into Bengali which means the number of readers of this literature is increasing day by day as well as the number of translators who can translate documents from these languages. Translations are also done from Ukrainian, Tibetan, Turkish, Armenian, and Dutch languages, which mean translations, are not only bound by the known and popular foreign language territory. Translations have also been done from the lesser known languages too.

It is also seen that translations from 18 different Indian languages to Bengali are found in the Indian National Bibliography, from 2016-2019. Among all the Indian languages, maximum translations were done into Bengali from the Sanskrit language. Many books were also translated into Bengali from Urdu, Pali and Hindi languages which mean the readers of these kinds of literatures and the translators are increasing day by day. Many translations are also done from Punjabi, Nepali, and Santali languages which indicate that in India, translations are not only done from the popular languages but also from local and lesser- known languages.

Data shows that a considerable amount of publication houses are there in Kolkata who published the majority of translated books which were included in INB. There are fewer publishers of translated books whose geographical location is other than Kolkata. Among them, Sahitya Academy from New Delhi, Westland from Chennai, and Oxford from New Delhi are much popular.

In 2016 translated works could be divided into four categories of literary forms. A maximum number of translated works was done in the fiction category. There is only one book that was in the Letter category. In 2017, there are 6 categories of the form available among translated work. It is seen that readers' demand had increased in different forms of literature slowly and

steadily. In 2018, only 3 types of forms were available in translated works. The number of works in poetry is nearly equal to fiction. In the year 2019 poetry books were translated a lot. 50% of the books were translated in fiction category every year from 2016 to 2019. Poetry books were also very much popular. In every year the percentage of translated poetry books is seen to be increasing. There are fewer drama books that are translated into the Bengali language. Maybe only a few translators are there who can take part to translate those in a proper way.

8. Conclusion:

In conclusion, it can be said that the study highlighted the trends and pattern of translated works in Bengali languages from the year 2016 to 2019, as depicted in INB. More or less in all the classes of DDC, translations have been found. Most of the translated works are found in Literature class, and in the fiction category.

Apart from Literature, works in the field of Religion are also seen. These fall mainly into two types- Buddhist philosophy and Vedanta philosophy. The number of translated publications is lower compared to the total publications in all the years. In all these years, publishers hail from across India. The number of translators has been gradually increasing. Maximum translations have been done from foreign languages. Also, a few translations have also been made from unfamiliar as well as local Indian languages. The conclusion can be drawn that though translated works form a very important part of a literary repository of a country , yet importance have not been given to the translated works uptil now in India. Authors have also not been encouraged to translate works, and there is no incentive to boost up their contribution in translation works. Another important fact is that there is no strict rule and regulations to force the publishers to deposit a copy of their publication to the National Library. Therefore many of the published works go unnoticed and also do not reach the hands of the scholars and are not added to the national repository. Exploration should be continued to focus on the translated works of other languages too, so that people may know the lacuna of this area in the national bibliographical database of India, i.e. Indian National Bibliography.

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Big Data Management in the Libraries of Bangladesh: Perceptions, Issues and Challenges

Mohammad Sharif Ul Islam *
Md. Roknuzzaman **

Abstract

Big data has gained significant attention from both academics and practitioners of a number of disciplines including library and information science (LIS). This paper intends to explore the perceptions of LIS communities towards big data management and the possible challenges of its implementation in libraries with a special reference to Bangladesh. The subjective opinions and deep insights of fifteen (15) experts of LIS domain in Bangladesh have comprehended the present standing of the information sectors. The experts' interviews of both groups suggest that big data management is still in its infancy in library practices and is limited to exploration and conceptualization stage. Libraries have an opportunity to be involved in big data management and to apply allied technologies in their operations and services. The study participants are hopeful, enthusiastic, and at the same time skeptical about its practical implications due to the technological and infrastructural constraints along with the funding and competencies issues. The findings suggest no libraries in Bangladesh formally practice big data-based librarianship; however, the professionals' theoretical and conceptual knowledge proved adequate with an occasional inconsistency and knowledge gap. The perceived competencies level lacks awareness, proper education and experiences. LIS community's views of the immediate effect on such technologies are not supported by the findings, and hence policy intervention and a long-term road map were suggested.

Keywords

Big data, Big data management, Big data tools, Libraries, Bangladesh

1. Introduction

Big data is the buzzword in the scientific community (Buhl et al., 2013) that mesmerizes our imagination with its unfolding potentiality (Chute et al., 2013), and thus, opens a new era of opportunities that change the traditional settings

* Assistant Professor, Department of Information Science and Library Management, University of Dhaka
** Professor, Department of Information Science and Library Management, University of Dhaka

of institutions, marketplace and human relationship by extracting new insights from data (Mayer-Schönberger and Cukier, 2013). Big data in its simplest term refer to the enormous and complex data sets that require a new set of skills and technologies to process it (Blummer and Kenton, 2018). Although it mainly deals with the three Vs; volume, variety and velocity (Sun, Strang and Li, 2018) where volume represents a huge amount, variety describes many different types of data, and velocity signifies the transmission speed of data (De Mauro, Greco and Grimaldi, 2016). IBM uses a fourth 'V' called veracity that denotes reliability of data *(Infographic: The Four V's of Big Data,* no date), and fifth 'V' that indicates the economic value of data is also commonly used in literature (Kaur and Sood, 2017). However, researchers also included sixth 'V' called validity that refers to correctness and accuracy of data to perform certain tasks, and seventh 'V' called volatility which is related to the retention period of data, as additional features of big data (Khan, Uddin and Gupta, 2014).

The hype of big data has emerged in various fields and segments, i.e., health, finance, governance, education, national security scientific research (Naik and Joshi, 2017). The library and information sectors are also thrilled by its potential benefits and challenges. The first and foremost question is whether the library needs do deal with big data? Teets and Goldner (2013) in their study argued, if all the metadata of the library's collection accumulated with their full text, that still probably will not fit in line with the characteristics of big data. *"However, when we look at these collections as a training set for all human knowledge, we can follow obvious data trails to generate massive collections of new relationship assertions. From a single work, we can extract relationships from co-authors, citations, geo-location, dates, named entities, subject classification, institution affiliations, publishers and historical circulation information. From these relationships, we can connect to other works, people, patents, events, etc. Creating, processing and making available this graph of new assertions at scale is big data (Teets and Goldner, 2013, pp. 430-431)."*

In the case of information sectors, besides the hype of big data; the advancement, acceptability, availability, and affordability of the internet and related technologies make the libraries flooded with data. Around 90% of today's world's data has been produced by the users' community in the last two years alone, and which holds around 2.5 quintillion bytes of data; Walmart on

an hourly basis handle over 2.5 petabytes of information; the financial fraud systems encounter fraudulent activities over 2 billion accounts; Facebook has over 45 billion photos (Kleyman, 2012).The exponential rate of data creation, captures, and use forecasted to reach around 64.2 zettabytes in 2010, and reach over 180 zettabytes in 2025 (Holst, 2021). These huge amounts of data require some advanced knowledge, technologies and competency to handle, collect, organize and disseminate information in a timely manner (Zhan and Widén, 2018). Besides, a huge number of newly created data are unstructured in nature, and not compatible with the traditional data management tools and techniques. Therefore, the libraries and information centers around the world are showing keen interest to incorporating cutting edge technologies into their library practices to ensure better users experiences. In the process, information professionals intended to identify the library's role in the big data environment, and suggest the libraries role should remain as simple as previously provided traditional library practices, i.e., to locate, organize, preserve, disseminate and provide access to their users with valuable information (Garoufallou and Gaitanou, 2021). However, the different characteristics of big data possess some new challenges specially in the management aspects; libraries need to find a solution to collect, organize, preserve, search and disseminate it (Blummer and Kenton, 2018). Besides, information professionals skills and training, data privacy along with copyright issues, uninterrupted and secured internet connection are some of the issues libraries need to encounter (Islam et al., 2020). Against such a backdrop, this particular paper aims to explore scholarly communications to identify the relevancy of big data in the overall library practices with a particular focus on the developing country's library set-up; specifically in Bangladesh. The library and information professionals' understanding, knowledge, attitudes, and current practices in Bangladesh are also under the scope of this paper.

2. Objectives and research questions

The extant literature indicates that libraries have a great deal with big data management. The review finds a gap of research in this area from Bangladeshi perspectives. Therefore, the major objectives of this study are to explore the perceptions of the select library and information science (LIS) academics and professionals of Bangladesh towards big data management (BDM), and to suggest measures for its in libraries. To address the defined objectives, the

study looks for answering to one major research question (MRQ) and four subsidiary research questions (SRQs).

- *MRQ:* What are the perceptions of LIS academics and practitioners in Bangladesh towards big data management?
- *SRQ1:* Why should libraries be engaged in big data management?
- SRQ2: What types of tools and techniques are suitable for big data management?
- *SRQ3:* What roles LIS professionals of Bangladesh can play in big data management environment?
- *SRQ4:* What are the possible challenges for the implementation of big data management in the libraries of Bangladesh?

3. Research design and methodology

Big data management in libraries is a new area of investigation. To our knowledge and existing literature shows no evidence of existing practices of big data management in the libraries of Bangladesh. The study adopted a qualitative exploratory and interpretive research approach. Exploratory research is usually carried out when the problem is at a preliminary or initial stage (Babbie, 2007), and it tends to handle new issues on which little or no prior investigation has been made (Brown, 2006). Besides the extensive review of relevant scientific literature, the study conducted experts' interviews of both professionals and academics. The participants were purposively selected, and the reason behind the interviews of both the groups was to incorporate the mixed feelings of theoretical and practical knowledge on such a new phenomenon. Qualitative data were collected using a semi-structured interview protocol via email and telephone. Professionals participants from National, Public, Special and Academic libraries were included. Some checklists were also applied, such as; educational background, experience, and reputation in the field to get a proper response. All the professional interviewees were either librarians, the head of the library or the library in charge. On the other hand, academics were included from all the reputed universities in Bangladesh having Honours and Masters degree in LIS or equivalent. Initially, fifteen professionals and six academics' responses were recorded. However, after careful examination ten (10) professionals and five (05) academics, qualitative responses were included for final data analysis as the rest of the responses

either were incomplete or iterated. The data were thematically analyzed which involves the process of reading through the text, identifying themes, coding, and then interpreting the content of the themes (Guest, Namey and Mitchell, 2013). For analysis of interview data, LIS academics were coded as LA1…LA5 and LIS professionals as LP1…LP10.

The study has some limitations too, for instance, the sampling methods. However, being exploratory research, the nature and topic of the study, the scarcity of the literature from the country's perspective, and also the ongoing pandemic situation might justify the chosen sampling techniques and also the number of participants.

4. Literature Review

4.1 Big Data and its related technologies

The concept of Big data refers to an umbrella term that comprises of data, technologies, and applications (Emmanuel and Stanier, 2016). Although, the term or concept of big data arguable around in the academic arena from the mid-1990s, and get widespread popularity and acceptability only after 2010; while hugely invested by the leading technological organizations like IBM and others; however, still some disparity of opinions exist about its definition towards the academicians and practitioners of the field (Gandomi and Haider, 2015). Many researchers and practitioners stressed on 3V's framework to refer big data; volume, variety, and velocity. The volumes refers to the size of the data, normally very large in quantity and measures in terabytes and petabytes, or even in exabytes, zettabytes, and yottabytes (Al-Mekhlal and Ali Khwaja, 2019). Variety indicates the diverse categories (raw, structured, semi or unstructured) and sources of data; in-formal communication, website, social media, geo spatial, camera, sensors etc., (Pence, 2014). Whereas, velocity indicates the speed of incoming data and processing speed that involves in different sources and stages of big data eco-systems (Katal, Wazid and Goudar, 2013). Many researchers define big data more or less in a similar fashion. For instance, Padmapriya et al. (2015) regarded big data as a massive and complex dataset that requires different methods to extract value in a large scale. According to a systematic review carried by Zhan and Widén (2019), big data denotes the ideas, tools, process or technologies' capability to handle massive amounts of data; both data and information might use interchangeably, and

thus possess same meaning. By summarizing some previous scholarly communication, Al-Mekhlal and Ali Khwaja (2019) state, big data refers to the dataset that possesses a mixture of features; huge, dynamic, diverse, interconnected, cost-effective etc., and by using relevant tools and techniques it can be used in numerous of ways. However, in a different paper, Japec et al., (2015) argued to include some new dimension in the big data definition, they added; besides all the Vs used in reference with big data , data creation place, new data types and processes involved to analyze and manage such data should covered by the characteristics of big data.

Nowadays we are bounded by a massive and an unprecedented data flow that offers new perspectives and solutions to long-lasting problems in various domains. In other words, people are adopting a more data-driven approach to develop strategies and find ways to solve the potential problems. However, data is generated not only at an exponential pace but also in various formats, structures and dimensions, and we define such type of complex data sets as big data. In brief, big data possesses a number of V's; from 3Vs to 5Vs and even in 7Vs (Pence, 2014; Sun, Strang and Li, 2018). On the other hand, data could be meaningless unless we extracted the insights from it, which forced us to build some mechanisms to collect, store and analyses of data. To fulfill these requirements, Apache Software Foundation makes a great effort and builds Hadoop; a collection of software that supports storage and processing of large-scale data. It is a java based programming platform that comprises of two components namely; i) Hadoop distributed file system (HDFS), and ii) MapReduce; where HDFS deals with distributed storage issues and MapReduce control distributed processing (Uzunkaya, Ensari and Kavurucu, 2015). As the inauguration of Hadoop caught many eyes and proved useful, the Apache foundation continued to develop their project to build much different software to boost the performance, and that formed a more extensive network of software called Hadoop Ecosystem. Hadoop Ecosystem could be categorized into three layers; storage, processing and management(Mishra, Mishra and Somani, 2017). In every segment, a myriad of approach is required to tackle different features of big data and users' requirements. For instance, to process data users could use MapReduce, Spark, and Storm; however, MapReduce supports batch processing whereas, Spark and Storm support real-time stream processing(Hedjazi et al., 2018). Hadoop Ecosystem is also

incorporated with HDFS (distributed file system), HBASE (database), YARN (resource manager), PIG (scripting), HIVE (analytical), Zookeeper (coordination) and so on(Apache Hadoop, no date). On a different note, to tackle any real-life problem Hadoop Ecosystem offers a lot, but we have to consider its (tools) strength, weakness and adaptability before deploying it to get the best result from the Ecosystem.

4.2 Use of Big data in libraries

• Data Management

Many researchers indicate the efficient handling, manage and dissemination of big data could prove to be cost effective in the long run, and can better suit the requirements of modern library users in terms of innovative decision making and recommendation systems (Wang et al., 2016; Al-Barashdi and Al-Karousi, 2019). However,one of the main challenges still exist associated with big data management is to efficiently handle, integrate, and store different distributed source's and types of data (Oussous et al., 2018). In the complex big data environment, real time data processing and analyzing is the key to provide efficient library services; and libraries are facing technological backdrops (Islam et al., 2020) on such aspects. Information systems at present are quite incompetent to handle and process large volumes of data or big data (Li et al., 2019). The main problem with large scale data is not about its size rather its types and formats; for instance, the unstructured data comprises of text, voices, Images, videos possess challenges to the traditional library set-up (Ahmad, JianMing and Rafi, 2019). In this context, Liu (2018) argued, the massive flow of unstructured, semi-structured and relational data makes almost impossible for the libraries to process and provide valuable insights, and subsequently a high performance based computing and software platform is required. Federer (2016) also emphasized the lack of infrastructure and standard. In order to overcome the limitations of the current storage devices, Bhat (2018) suggests, the new emerging storage technologies such as, DNA, optical, and holographic could be the options to store massive data flows. Besides, the capacity to handle big data effectively the current library's standalone cyber infrastructure (CI) proved inadequate and require shared CI; different commercial cloud based solution exist to assist the process, like Amazon Web Services, Rackspace along with some developed country based solution that includes Virginia Tech's BlueRidge, Open science data etc. (Xie and Fox, 2017). Many

researchers argued in favor of parallel computing model along with distributed storage system to efficiently store and manage big data (Simović, 2018). Some even, proposed a big data application model solely for libraries based on large scale network analysis (Zheng et al., 2018).

• *Security and privacy*

Security and privacy are one of the major concerns while adopting big data based tools, techniques, and services in the information sectors (Vaidhyanathan and Bulock, 2014; Harper and Oltmann, 2017). Privacy is one of the fundamental rights of human being and has been endorsed in different deceleration of human rights. Libraries are always highly sensitive to uphold any privacy related issues among their patrons. In the arena of big data, the ever growing popularity of social media, open platform along with different technological advances and geo-cultural variables makes information organizations to revisit their roles and vows to protect human rights and privacy (Cooke, 2018). Many researchers expressed their concern about data security and privacy in the big data environment (Chen et al., 2015; Ye et al., 2016; Bertino and Ferrari, 2018). In the digital environment, people voluntarily provide personal information in different digital platform without the intention to share that information with third parties. However, sometimes third parties can gain access to these information and can extract valuable information (Mai, 2016). Many big companies also can access to users data easily. For instance, Facebook store all social events and activities' data, Google and amazon easily can identify users shopping habits and preferences, you tube use search history, altogether users privacy can breached anytime to get business benefits (Mehmood et al., 2016). In this reality, libraries are adopting a holistic approach that includes enhancing technological capacity, staff and users training, awareness building and policy intervention. Cowan argued library can provide efficient users protection through RDA and linked data (Campbell and Cowan, 2016). Sun and Ma (2014) provided some specific suggestion to improve data security and privacy, such as, i) to discard unrelated data of the users by employing filtering, cleaning, and deletion; ii) to insure the provisions of anonymity, encryption, encoding etc. in big data application platforms; iii) increase users control over personal data; iv) comply with the libraries data security and privacy guidelines while the third party's involvement in data sharing and analyses.

• *Information professionals' knowledge, attitudes, perceptions, and competency*

It is undoubtedly a big challenge for the information professionals to be familiar, cope and perform certain activities related to handling big data in libraries. Many researchers have given special emphasizes to the staffs' competencies with big data (Zhan and Widén, 2019; Panda, 2021). In this context, LU et al., (2017) mentioned the information professional are well aware of the latest advancement in the technologies, and he claimed in his paper about the familiarities of big data among the library and information professional communities. This could be linked to their vast experience and knowledge of traditional database management systems (Ahmed and Ameen, 2017). Most of the papers in big data are specifically carried in the developed countries; however, some paper also tried to address the information professionals' competencies level from a developing country's setup. For instance, Ahmad, JianMing and Rafi (2019) carried a survey in a South- Asian country which intended to explore the librarians' knowledge about big data, and found that librarians mostly familiar with the concept and characteristics of big data with some knowledge gaps in certain aspects of big data analytics. In a different studies that employed over five hundred participants working in science library were asked about their confidence level about data management. The results revealed that the highest percentage that stands at 31% lacks data management skills, and around 23% expressed their confidence in such skills, while another 14.2% were unsure, and the rest of them mentioned they are actively acquiring related knowledge and skills (Antell et al., 2014). Therefore, many researchers are skeptical about their competencies to handle big data, and give emphasis to acquire new knowledge and skills (Ullah and Anwar, 2013; Ahmad, JianMing and Rafi, 2019). They urge the library professionals to overcome if any technological fear they possesses and learn the advance tools and techniques in a collaborative manner from their institutions, colleagues, and peers (Oakleaf, 2016; Braganza et al., 2017). Liu (2021) added, a significant number of librarians are unprofessional, and thus require a policy intervention to create job opportunities for the qualified one along with the training opportunities for continuous development to assure better service. In a similar vein, Burton and Lyon (2017), acknowledged the knowledge gap, and suggests to get involve in various academic programs, short course, and workshop.

5. Data analysis and discussion

5.1 Perceptions on big data and its management

The concept of big data is known to both LIS academics and professionals, and theoretically, their levels of understanding usually range from familiarity to advanced knowledge. Among the respondents, only two librarians reported to have some sort of practical knowledge of dealing with big data in the library. Most of the interviewees considered big data as large in volume which require huge storage capacity and computational skills to handle. From libraries' points of view, the management of big data involves the systematic process similar to that of managing content or information performed by the librarians. The major themes emerged from the interview data on big data and its management are summarized in Table 1.

Table 1: Major themes on big data and its management

Questions	Major themes	Extracted from
What is big data?	• The ever-growing structured and unstructured bulk data— difficult to process conventionally.	LA2, LP9
	• Massive complex data-sets characterized by volume, velocity, variety, veracity and value.	LA3, LP6, LP10
	• Big Data is all about petabytes, exabytes, or zettabytes (Yeoman, 2019)	LA1
	• Big data may not always be big—may be small in size, but complex in nature.	LP4
	• The storage and analysis of large and or complex data sets using a number of techniques (Ward and Barker, 2013)	LP8
What is big data management?	• A broad concept encompassing the policies, procedures and technologies used to collect, store, govern, organize, administer and deliver large repositories of data (Harvey, 2017)	LA2
	• The administration, management and governance of large volumes of all types of data (Stedman, n.d.)	LP5
	• Refers to data identification, filtering, aggregation, analysis and visualization,	LA1, LP3
	• Organizational strategies and policies for collecting, organizing and retrieving large amount of diverse data-sets.	LP8
	• The acquisition, analysis, curation, storage and usage of data.	LA3

5.2 Libraries' involvement in big data

Libraries deal physical as well as electronic data, and the amount of data and the variety of formats are making the data large in size (Pradhan and Hiray, 2020). In view of this perspective, big data should be a major part of library activities, but the result of this study indicates that none of the libraries have applied big data in their operations and services in the real sense of the term. Even three of the participated librarians opined negatively about the incorporation of big data in their libraries considering their existing infrastructural facilities. One such response came as: "I do not think currently we have the opportunity to deal with the big data in our library" (LP7). Only two librarians, however, claimed that they incorporated some of the applications of big data in library practice including creation and management of huge bibliographic records, metadata creation, management of users' data, management of circulation records, etc. Whatever be their engagement in big data management, all the interviewees agreed that libraries have an opportunity to make contribution to big data environment with their vast experience of data and record management. As mentioned in Box 1, the librarians identified some forms of big data that libraries usually deal with;

Box 1: Some forms of library big data

- Large volume of physical and electronic resources
- Bibliographic data of library holdings
- Metadata of institutional repository
- Collected metadata of subscribed journals from different publishers
- Data on serials control
- Users' profile information
- Users' search information
- Information of check-in and check-out of books
- Data on downloading and hit items
- Research data on diverse fields
- Webometric analysis services
- Patterns of queries and attitudes of users, and utilization of resources
- SMS service data,
- Social Media analysis.
- User statistics/report analysis, etc.

Majority of the LIS academics and professionals believed that big data can excel library practice and librarians should be engaged in big data management to contend with fast-growing pools of data. "Certainly, it's our job! It's time to apply big data in our libraries; otherwise we'll fail to keep pace with others" (LP3). A number of factors emerged as an answer to a question of why libraries should be involved in big data management:

- Library can use big data tools to analyse large pool of data sets, users record and thus be able to offer innovative library products and services.
- Using big data analytics, libraries can develop large volume of quality collection by tracking the usage of library materials, knowing users' feedback and measuring their satisfaction level.
- Big data can aid in developing marketing strategies and improving new data formats for libraries ensuring more efficient transmission and data visualization.
- Big data can help LIS professionals keep up with the current trends and tackle challenges that their patrons may encounter.
- Libraries can be a hub of research data management services by incorporating big data into library collections where traditional data management tools will not be suitable.
- Big data analytics strengthen the library data analytics that would provide meaningful insights for strategic decision making in the libraries.

5.3 Big data management tools and techniques

Past studies have identified latest tools and techniques for data collection, storage, filtering and extraction, cleaning and validation, etc. (e.g. Ratra and Gulia, 2019). According to De Mauro, Greco and Michele (2016), big data analytical methods include cluster analysis, genetic algorithms, natural language processing, machine learning, neural networks, predictive modelling, regression models, social network analysis, sentiment analysis, signal processing and data visualization. These tools and techniques are completely related to data science, computing and business domains. Libraries usually deal with traditional data management systems, and the study participants also confirmed their lack of knowledge of the latest tools and technologies used for

big data management in libraries. One of the interviewees reported: "…some tools of big data management are known by the names but not by practice; even we don't know how effective such tools will be for libraries" (LP3). In view of LP5, traditional library management software/tools are in some cases used for handling library big data, but in fact, these are not suitable for dealing with complex nature of big data. From practical experiences, LA2 mentioned: "sometimes, we use Google analytics to know the user behaviour on a library website. We also use OpenRefine for working with messy data". Though the libraries were not using big data analytics and management tools, some of the interviewees suggested a number of tools and techniques that can be applied for big data management in the libraries of Bangladesh in future (Table 2).

Table 2: Common big data management techniques and tools

Big data management techniques	Big data management tools
• Big data analytics • Data storage • Data mining • Cloud computing • Statistics • Machine learning • Artificial Neural Network • Social Network Analysis • Data visualization, etc.	• **Apache Hadoop** • Apache spark • **Microsoft HDInsight** • **Hive** • Oracle NoSQL Database • Trackur • MapReduce • **Rapidminer** • Content Grabber • Scraper • Google Fusion tables • **R** • **Python, etc.**

5.4 Roles of LIS professionals

Libraries have long been familiar with the curation of scientific data; research data management services, scientific data navigation services, integrated data retrieval systems, promotion of open access and scholarly communication, etc. which are often referred to as the major duties of data specialists (Virkus and Garoufallou, 2020). To some extent, the LIS professionals of Bangladesh are also engaged in such activities, but most of them are concerned with the

traditional data management systems. They need to acquire a rich mix of skills and competencies to play a significant role in big data management environment. This study further identified the possible roles that LIS professionals can play in big data management which are consistent with the findings of data science roles as mentioned by Salman, Abdullah and Sahid (2020). Table 3 summarizes the new roles and responsibilities of LIS professionals in big data management.

Table 3:Roles and responsibilities of LIS professionals in big data management

Roles	Responsibilities
Chief Data Officer (CDO)	Lead the overall data governance program including data approval, program setting, funding, staffing, monitoring, etc.
Data Librarian	Manage research data and linked data, support organizations' research activities.
Data Manager	Manage and supervise organizations whole data, networks, and systems
Data Developer	Comply with patrons and organisations requirements related to design and develop database systems, increase efficiency in existing systems.
Data Analyst	Acquire data from different sources; produce reports and extract relevant value from complex datasets.
Data Curator	Handle metadata, data dictionaries and data sets; determine best practi ces for working with data.
Data Administrator	Ensure security, increase performance of the database and systems.
Data Consultant	Provide consultative guidance, design research plans and perform data research, develop and document data model and guidelines, and assist management's decision making process.
Data Steward	Perform functions related to documentation of data including data policies, data guidelines and data processing, and make them available to their users.
Data Engineer	Develop and test algorithms for certain requirements of the system and produce new complex systems if required.
Data Archivist	Deal with long-term storage, maintain and update of archival data.

5.5 Challenges of big data management

The emergence of big data has created new scopes and opportunities for libraries and at the same time it has posed a number challenges for LIS professionals. One of the interviewees remarked: "most LIS professionals in the country may not appreciate the value of big data because of their lack of awareness of the issue. Hardware/software and the environment required for data warehousing is expensive. Besides, technical knowledge is required for building and managing big data" (LA2). The analysis of interview data summarizes the possible challenges that LIS professionals might encounter when implementing big data management in their libraries.

- Lack of understanding: Most LIS professionals in the country have lack of knowledge and understanding of big data and related technologies. Even they are not aware of the applications big data management in libraries.
- Failure to recognize the value of big data: Library authority does not recognize the potential benefits of big data in library and information sector.
- Lack of big data skills and competencies: One of the most significant challenges is the lack of skills and competencies of library staff required to deal with advancedtools and techniques of big data management.
- Weak infrastructural facilities: Big data management requires sound infrastructural technical infrastructural facilities. Improper technological infrastructure is a major challenge for the implementation of big data management in libraries.
- Inadequate financial support: Big data management is a costly effort but many of the libraries are in the crisis of adequate budget. Hence, the library authorities do not take initiatives to apply big data management in libraries.
- Data privacy and security: Ethical issues like data privacy and security are a big concern for the management of big data in libraries.
- Absence of big data management policy: The absence of institutional and/or national policy on big data management in the country hinders its implementation in library practices.

6. Conclusion and Recommendations

The roles, responsibilities and competencies of information professionals in the context of big data have been well addressed in various scholarly communications and have gained keen attention from the administrative positions involved in information sectors. They have been deeply engaged to address any new phenomena and revisited required policy interventions where needed along with setting new rules, regulations and standards, especially in the context of the developed countries. To get a divisible solution many seminars, symposiums, formal and informal workshops have been undertaken with the help of both national and international organisations like CILIP, ALA, IFLA, etc. However, despite the combined efforts by the library and information professionals along with the concerned leaders, researchers and educators of the field, the adoption of big data and related technologies to the library practices and services are yet to be slow. On the other side of the spectrum, library and information professionals of the developing countries are still constantly engaged to convert, manage and administer the digital or hybrid library systems. In the case of Bangladesh, based of the findings, none of the libraries have applied big data in their operations and services in the true sense of the term, and they use traditional data management tools and technologies. The findings, however, shed light on the positivity of the information professionals about big data and related technologies. They possess knowledge gap, infrastructural shortage, professional incompetence, financial constraints and policy debate, etc., but their enthusiasm and good vibe will lead the young professionals in the right path to overcome those existing challenges and adopt more advanced, sophisticated and data-oriented library practices. In this context, the study suggests the following measures to be adopted for the implementation of big data management in the libraries of Bangladesh:

- Both library authority and staff should recognize the value of big data management in libraries. They should have clear understanding of the global trends of big data.
- Librarians should be proactive and they must have an intention to adopt new innovations and latest trends in library practices.
- LIS schools should incorporate data science courses in their curricula.
- Library authorities and professional bodies should take initiatives to create awareness among LIS professionals, educators, researchers, and

other concerned stakeholders through organizing seminars, conferences, workshops, short courses, training, etc. on big data management and allied technologies.

- Adequate money, resources and efforts should be invested to strengthen human and institutional capacity in terms of developing professional competencies of the staff, creating new data specialists, enriching technological infrastructure of the libraries, etc.
- The concerned authorities should create and offer new job opportunities for the LIS graduates to make a whole new generation of data savvy professionals.
- Policies and ethical guidelines at national and institutional levels should be formulated for successful implementation of big data management in the libraries of Bangladesh.

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Evaluating User Information Need and Satisfaction Level at Selected Academic Libraries in Bangladesh

Sabrina Aktar *
Umme Habiba **

Abstract

This study aimed to evaluate library users' information needs and their satisfaction level regarding the information resources and services of selected private university libraries in Dhaka City. For undertaking this study, the authors selected five top ranked private universities in Dhaka and a questionnaire based survey was conducted for data collection. Subsequently, the questionnaire was distributed among different categories of users, i.e., faculty members, postgraduate students, graduate students, and administrative staff, and received 317 filled-in questionnaires. The survey attempted to measure the users' information needs with a frequency of library visits, purpose, tools for using resources, opinion about the availability of the resources and level of satisfaction, as well as identify the problems faced by the users. This study also proposed some recommendations to fulfill the information needs and improve users' satisfaction. If the authorities of the university libraries follow the proposed guidance, the libraries will be successful in identifying information needs and delivering satisfactory services to the users.

Keywords

Information needs, user satisfaction, information services, academic library, Dhaka City.

Introduction

Academic library is considered an important place to gain and share knowledge, preserve and manage research work, and enhance academic achievement (Townley, 2001). Academic libraries are attached to educational institutions for fulfillingtheir core organization's mission (Aman, 2010). It is a key platform for organizing and promoting scholarly works. These libraries are an important part of academic institutions, which cater to the needs of the

* Lecturer, Library and Information Science, National University, Bangladesh
* * Assistant Professor, Institute of Information Sciences, Noakhali Science and Technology University, Bangladesh

researchers and general students (Atkinson, 2019). Since academic libraries are a vital component of the broader learning and knowledge acquiring system, they must disseminate wide ranging services for learning, education, research work, as well as producing new knowledge (Shukla, Singh, and Mishra, 2013). Library and information professionals of the academic libraries are receiving the users' queries and provide services to fulfill their needs. The University library is committed to disseminate information resources and services to the client, and the library must forge an effective relationship with the user groups and fulfill their needs (Pareek and Gangrade, 2016). If the university libraries are to develop the quality of their services, to stay relevant in this volatile competitive environment, they need to organize their services taking into consideration the users' information needs and to provide user-oriented services, the library should know the user groups and their needs (Gunasekeraf, 2010). Academic libraries assist the the faculty members and students to carry out academic and research-related activities (Klain and Shoham, 2019). The role of Information resources is indispensable in the area of learning, teaching, research work, and professional development.

Information is rapidly increasing in ever-spreading dimensions and scale, in the whole circle of human action. In the context of information explosion, the library is changing its services according to the demand of end-users, evaluating information requirements and user satisfaction (Rehman, Shafique, and Mahmood, 2011). This study tried to evaluate information needs and the level of user satisfaction at academic libraries. Library users (faculty, postgraduate students, graduate students, and administrative staff), library collections, library services, library structure, and user satisfaction of the academic libraries were considered as variables in this study.

Literature Review

Many studies have been carried out on user satisfaction in Bangladesh and worldwide. This study reviewed a few important studies that are correlated with this study purpose. Information plays a vital role in our professional and personal lives, and individuals need information to work effectively in their concerned fields of knowledge (Tahir, Mahmood and Shafique, 2008).

Benard and Dulle (2014) in their study revealed that students most frequently used information sources like books and novels. Other information resources such as atlas and maps, dictionaries, stories, audiovisuals, and poetry, were not widely used by the respondents. Saikia and Gohain's (2013) investigation revealed that 146 (91.25 %) users accessed law college libraries for searching books and reading materials based on their chosen topics. In their study, Hemavath and Chandrasekhara (2018) revealed that in the case of newspaper clippings service, a majority (91; 56.88%) of users were satisfied. The study further recommended that law college libraries should carry out user studies regularly to know about and increase the use of desired resources. Shokeen and Kushik (2002) verified the faculty members' information searching tradition in various disciplines. The result of the study revealedthat the maximum number of faculty members used library resources daily, and their most frequently usedtools wereindexing and abstracting periodicals. A recent study by Habiba and Ahmed (2020) found that most of the respondents used e-journals, e-books and e-newspapers. Korobili, Tilikidou, and Delistavrou's (2006) study found that most TEI faculty members used printed sources, but they frequently used online resources such as websites, journals, and books. In their study, Islam and Habiba (2015) found that most respondents informed that they used online resources for learning purposes, for getting current information onresearch. Another recent paper by Habiba and Ahmed (2020a) found that the highest number of faculty members used e-resources for research work, individual study, getting assistance for pedagogy, and for updating their subjective understanding.

Kassim (2009) conducted a study where questionnaire was disseminated to 650 students of the final year from three faculties of the University in Malaysia. The outcome of the analysis exposed that the respondents were moderately satisfied with library services, collections, structure, and library resources. Andaleeb and Simmonds (1998) specified that users of the academic and other libraries expected the library staff to be educated and well informed and interested in assisting them in finding desired resources and receiving information services rapidly and competently. Skilled staff can create positive attitude in the minds of the user, and difficulties in obtaining desired information is resolved quickly with greater satisfaction

(Muthuvennila and Kannan, 2020; Tiemo and Ateboh, 2016). Habiba and Ahmed (2020b) conducted a study at both public and private university libraries to explore present situation of IT facilities, access to e-resources in universities, and faculty satisfaction with university subscribed e-resources in Bangladesh. They found that the majority of the library administrators declared that they had difficulties, i.e., insufficient financial aid and lack of qualified human resources. Additionally, they also revealed that faculty members were not satisfied with the existing resources that the university libraries subscribed. Verma and Laltlanmawii (2016) stated that user satisfaction shows a picture of how effective the library is for the users in terms of materials and services. The information seeker is the key stakeholder in a library, and library activities are administered for user satisfaction (Connaway and Faniel, 2014; Dominici, Palumbo and Basile, 2015). Though, it is true that every library cannot always achieve user satisfaction because of inadequate resources and incapability of satisfying the needs of the users, some libraries can achieve a higher level of user satisfaction by disseminating required information to the users (Tetteh and Nyantakyi-Baah, 2019; Mairaj and Naseer, 2013). Consequently, adequate resources of the libraries can have a substantial impact on user satisfaction. Most users have fluctuating requests and demands, and the library worker's responsibility is to identify the request and needs (Tait, Martzoukou, and Reid, 2016).

Users' satisfaction is usually appraised by the library professionals' full services and resources (Odu, 2017). It also clarifies the library professionals' concept on the services and their hypothesis about user expectations. Jahan (2017) conducted a study about faculty members' perceptions and knowledge on information needs and information searching practice. The study found that majority of faculty members used the library once a week, whereas others visited the library more than once a week. Additionally, the study result showed that, smallestpercentage of faculty members were using general books. Faculty members were relatively more satisfied with online journals, OPAC and were less satisfied with electronic resource collections. Ahmed (2013) pointed out that faculty members were not generally satisfied with the existing subscribed e-resources of the university, and they also faced some difficulties such as finding desired resources, access to resources from home, slow download speed, and so on.

Nicol and O'English (2012) revealed that students and faculty members were satisfied with library facilities because the library made information resources accessible to them. Rupp-Serrano and Robbins (2013) investigated the practice of searching information with respect to conducting research by faculty members of twenty universities. The study investigated how regularly the faculty members searched for knowledge and keep abreast with recent progress in the specific field. The faculty members indicated the importance of e-resources and library databases for meeting their information and research needs. Gowda and Shivalingaiah (2010) conducted a study on the research scholars in the University Libraries in Karnataka, and the results revealed that there was significant difference among the researchers of several disciplines in the methods of searching, goals of using the library, and time consumed in searching information. In a study, Tahir, Mahmood and Shafique (2008) explored the information needs and searching habits of faculty members. The study revealed that consulting with experts in their subject field was the favored method of retrieving desired sources, and they also consulted with their colleagues for information.

From the above discussion, it is clear that there is a gap in the literature regarding the academic library services and user satisfaction at all levels, such as faculty members, library professionals, and students. Though a number of studies have been conducted on information needs and satisfaction about e-resources subscribed by the universities, (e.g., Habiba and Ahmed, 2020a; Habiba and Ahmed, 2020b, Ahmed, 2013;Habiba and Chowdhury, 2012; Islam and Habiba, 2015), this is a uniqueeffort to explore users' information need and level of satisfaction covering demographic groups: faculty members, library professionals, and students. This study has the following objectives:

1. To indicate the searching tools most used by library users ;
2. To measure the satisfaction about information resources by the library users ; and
3. To suggest recommendations for better services to fulfill users' information needs and increase their satisfaction level.

Methodology

The study applied quantitative approach to collect data. It was limited to five private universities in Dhaka city. This research tried to evaluate academic library users' information needs and satisfaction in Dhaka city. The questionnaire items about the user needs, and satisfaction were selected from the previous research studies in a modified way (Muthuvennila and Kannan, 2020; Hemavath and Chandrasekhara, 2018; Habiba and Ahmed, 2020a; Tiemo and Ateboh, 2016; Connaway and Faniel, 2014; Dominici, Palumbo and Basile, 2015). The questionnaire (See Appendix) was sent to the respondents to know about their attitudes and feelings regarding the concerned academic library's information resources and services. For collecting data, the authors selected five top ranked private universities. The selected universities were: North South University (NSU), East-West University (EWU), Eastern University (EU), Bangladesh Islamic University of Technology (BIUT), BRAC University.
The respondents of this study included:

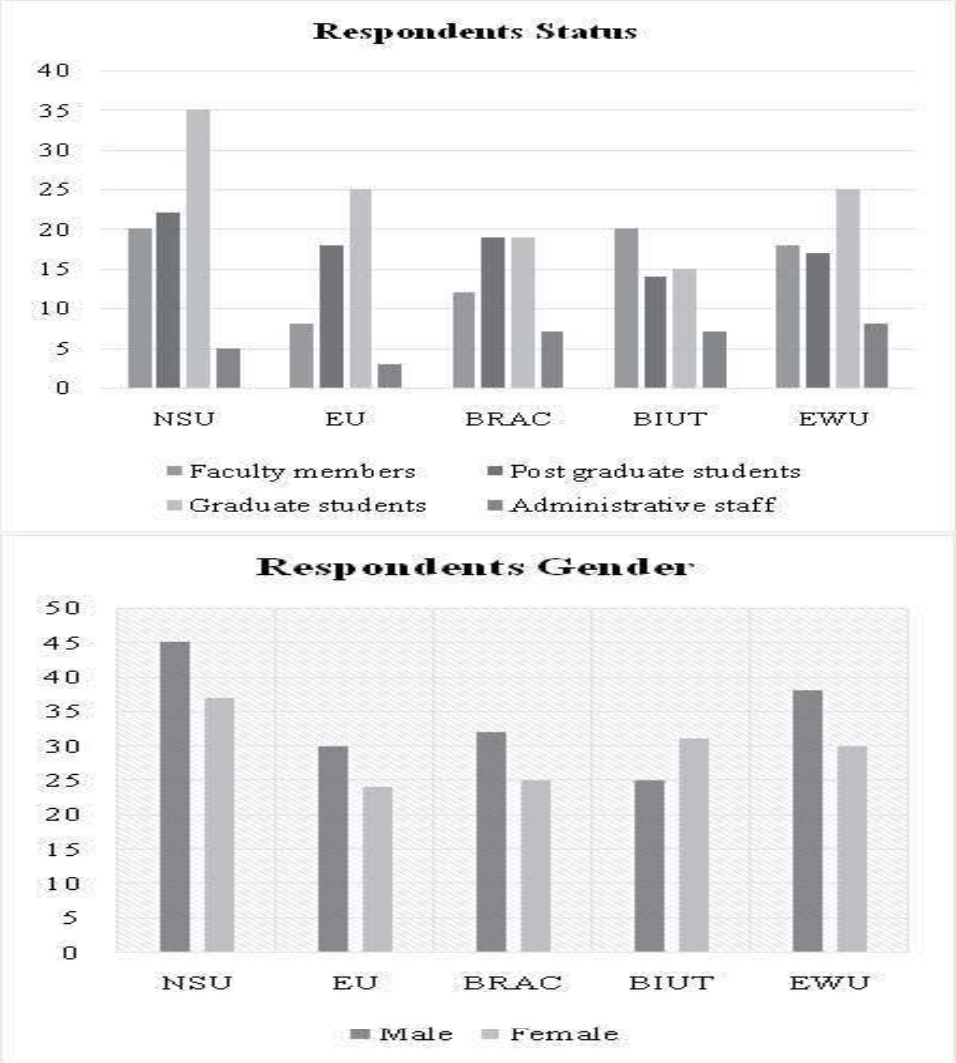
- Faculty members;
- Graduate and postgraduate students;
- The library staff.

There are 103 private universities in Bangladesh (University Grants Commission, 2021). The present study randomly provided more than 900 questionnaires to respondents who are engaged with these selected universities and received three hundred seventeen (317) responses from different categories (i.e., faculty members, library administrative officers and students). For analysis of data, SPSS 20 and Microsoft Excel software have been used for descriptive analysis.

Results:

Demographic information of the respondents

Figure 1 and 2 illustrated the respondents' demographic information. Out of the five private universities, NSUrecorded the highest number of respondents, (faculty members= 20, Postgraduate students=22, Graduate students=35, and Administrative staff=5). The number of respondents in other universities was: EWU=68, BRAC=57, BIUT=56, and EU=54.Out of the 317 respondents, n=151 were female, and n=134 were male respondents.



Frequency of library visit by respondents

It is noted from Table-1 that NSU library users, i.e., the highest percentage of users of NSU library (41.46%) visited the library occasionally. EU library users visited the library daily 13(24.07%) and once in a week by 22(40.74%). The highest percentage of BRAC university library users visited the library occasionally 32(56.14%) and daily 10(17.54%). BIUT library users also visited the library occasionally 44(78.57%) and daily by 10(17.85%). Finally, it is also noticeable from Table 1 that the EWU library users also occasionally visited their library 45(66.17%) and 18 (26.47%) daily.

Table 1: Frequently visit of library by the respondents

Univ.	Categories of respondents	Frequently visit of library					Total
		Daily	Once in a week	Twice in a week	Three times in a week	Occasionally	
NSU	Faculty	-	05	02	03	10	20
	Postgraduate	08	03	02	-	09	22
	Graduate	10	15	-	-	10	35
	Administrative staff	-	-	-	-	05	05
	Total	**18(21.95%)**	**23(28.04%)**	**04(4.87%)**	**03(3.65%)**	**34(41.46%)**	**82**
EU	Faculty	-	04	01	-	03	08
	P. graduate students	-	17	-	-	01	18
	Graduate students	13	05	0	-	07	25
	Administrative staff	-	-	-	-	03	3
	Total	**13(24.07%)**	**22(40.74%)**	**1(1.85%)**	**-**	**14(25.92%)**	**54**
BRAC	Faculty	-	02	-	-	10	12
	P. graduate students	03	02	05	-	09	19
	Graduate students	07	05	-	-	07	19
	Administrative staff	-	-	-	-	07	07
	Total	**10 (17.54%)**	**09(15.78%)**	**5(8.77%)**	**-**	**32(56.14%)**	**57**
BUIT	Faculty	02	-	-	-	18	20
	P. graduate students	03	02	-	-	09	14
	Graduate students	05	-	-	-	10	15
	Administrative staff	-	-	-	-	07	07
	Total	**10(17.85%)**	**2(3.57%)**	**-**	**-**	**44(78.57%)**	**56**
EWU	Faculty	-		03	-	15	18
	P. graduate students	03	02	-	-	12	17
	Graduate students	15	-	-	-	10	25
	Administrative staff	-	-	-	-	08	08
	Total	**18 (26.47%)**	**2(2.94%)**	**3(4.41%)**	**03(3.65%)**	**45(66.17%)**	**68**

Purpose of library visit by users

Table-2 indicates that the respondents from all the selected universities at all levels except faculty members (i.e., Postgraduate, Graduate, and Administrative staff) explored information by reading general books 139(43.8%). Moreover, 65(20.5%) of the respondents visited the library for research purpose, of which most of the respondents are faculty members. Furthermore, 47(14.8%) of the respondents claimed, they usually came to the library for collecting teaching

materials. Comparatively, fewer responses were recorded for using IT facilities 19(10.0%), 25(7.9%) for periodical articles, for recreation 23(7.3%).

Table 2: Purpose of library visit by the respondents

Univ.	Categories of respondents	Purpose of Library Visit						Total
		General books	For research purpose	Periodical articles	Using IT facilities	Recreation	Teaching materials	
NSU	Faculty	-	15	-	-	-	05	20
	Postgraduate	18	02	02	-	-	-	22
	Graduate	30	-	-	03	02		35
	Administrative staff	05	-	-	-	-	-	05
EU	Faculty	-	08	-	-	-	-	08
	P. graduate students	14	-	02		02	-	18
	Graduate students	11	0	0	3	5	7	25
	Administrative staff	03	-	-	-	-	-	3
BRAC	Faculty	-	05	01	-	-	06	12
	P. graduate students	06	04	02	03	02	02	19
	Graduate students	11	-	-	03	02	03	19
	Administrative staff	03	0	-	-	-	02	07
BUIT	Faculty	-	10	05			05	20
	P. graduate students	05	01	02	-	03	03	14
	Graduate students	08	-	-	-	05	02	15
	Administrative staff	02	02	02	-	-	01	07
EWU	Faculty	-	15	02	-	-	01	18
	P. graduate students	08	02	02	02	02	01	17
	Graduate students	11	01	03	05	-	05	25
	Administrative staff	04	-	02	-	-	04	08
	Total	**139(43.8%)**	**65(20.5%)**	**25(7.9%)**	**19(10.0%)**	**23(7.3%)**	**47(14.8%)**	**317**

Type of information sources and services used by the respondents

Table-3 showed the categories of information sources and services used by the participants. The result revealed that most of the respondents, i.e. 185(58.4%) at all levels from all selected universities used books as the main source of information. Besides, 46(14.5%) users used CAS& SDI services, followed by 31(9.8%) using reprographic services and 30(9.5%) used journals. In contrast, it was also noticeable from Table 3 that the lowest number of respondents of NSU library (i.e. 0.6%) used indexing & abstracting services and audio-visual services.

Table 3: Type of information sources and services used by the respondents

Univ.	Categories of respondents	Type of Information sources and services used by the respondents								Total
		Books	Journals	CAS& SDI services	Reference & referral services	Reprograp hic services	Indexing & abstracting services	Audio-visual services	Bibliographic services	
NSU	Faculty	10	05	01	02	-	-	-	02	20
	P. graduate students	7	02	02	05	6	-	-	-	22
	Graduate students	15	03	02	03	05	02	02	02	35
	Administrative staff	05	-	-	-	-	-	-	-	05
EWU	Faculty	04	02	02	-	-	-	-	-	08
	P. graduate students	08	-	5	01	4	-	-	-	18
	Graduate students	15	-	05	-	05	-	-	-	25
	Administrative staff	03	-	-	-	-	-	-	-	3
BRAC	Faculty	11	01	-	-	-	-	-	-	12
	P. graduate students	13	05	-	01	-	-	-	.	19
	Graduate students	15		03	-	01	-	-	-	19
	Administrative staff	7	-	-	-	-	-	-	-	07
BUIT	Faculty	11	03	05	-	01	-	-	-	20
	P. graduate students	03	02	05	01	04	-	-	.	14
	Graduate students	13	01	01		-	-	-	-	15
	Administrative staff	07	-	-	-	-	-	-	-	07
EWU	Faculty	11	01	07	-	-	-	-	-	18
	P. graduate students	09	-	05	03	-	-	-	-	17
	Graduate students	13	05	03	02	02	-	-	-	25
	Administrative staff	05	-	-	-	03	-	-	-	08
	Total	**185(58.4 %)**	**30(9.5 %)**	**46(14.5 %)**	**18(5.7%)**	**31(9.8%)**	**2(0.6%)**	**2(0.6%)**	**4(1.3%)**	**317**

Categories of searching tools used by the respondents

The respondents were asked about the types of searching tools they used for retrieving their desired documents or information from the library. From Table-4 it was found that the largest number of respondents 137(43.2%) at all levels used self-search mechanism for retrieving information. Moreover, 81(25.6%) respondents generally used card catalog for searching documents. It was noticeable that only 34(10.7%) of the respondents used OPAC, and 33(10.4%) used a full-text library database for searching information. Besides, 28(8.8%) users consulted with library staff to get their desired items.

Table 4: Searching tools used by the respondents

Univ.	Categories of respondents	Searching tools					Total
		Shelf search	Card Catalogue	OPAC	library staff	Full-text library database	
NSU	Faculty	-	15	-	05	-	20
	P. graduate	15	05	02	-	02	22
	Graduate	25	-	-	05	05	35
	Administrative staff	-	-	-	-	05	05
EU	Faculty	03	05	-	-	-	08
	P. graduate students	12	-	04	-	02	18
	Graduate students	09	4	02	5	5	25
	Administrative staff	-	03	-	-	-	3
BRAC	Faculty	05	05	02	-	-	12
	P. graduate students	06	05	03	03	02	19
	Graduate students	09	07	-	-	02	19
	Administrative staff	03	-	-	-	-	07
BUIT	Faculty	10	05	05	-	-	20
	P. graduate students	07	03	02	-	02	14
	Graduate students	05	02	-	03	05	15
	Administrative staff	03	02	02	-	-	07
EWU	Faculty	10	08			-	18
	P. graduate students	05	05	05	02	-	17
	Graduate students	07	05	05	05	03	25
	Administrative staff	03	02	02			08
Total		**137(43.2%)**	**81(25.6%)**	**34(10.7%)**	**28(8.8%)**	**33(10.4%)**	**317**

Respondents' satisfaction with the information sources and services

Table-5 showed that 192(60.6%) of the respondents were fully satisfied with their library sources and services at all universities. A substantial percentage of users (14.1%) were partially satisfied with the information resources and services. In contrast, 76(24.0%) respondents at all levels were dissatisfied regarding the library resources and services that the library provided. This finding is related to the study conducted by Habiba and Ahmed (2020b), and Ahmed (2013), whoargued that university faculty members were not fully satisfied with university-paid online resources.

Table 5: Satisfaction with the information resources and services by the respondents

Univ.	Categories of respondents	Satisfaction on information resources and services			Total
		Fully satisfied	Partially satisfied	Dissatisfied	
NSU	Faculty	05	13	02	20
	Postgraduate	07	03	12	22
	Graduate	13	21	05	35
	Administrative staff	03	-	03	05
EU	Faculty	02	02	04	08
	P. graduate students	13	-	5	18
	Graduate students	21	0 3	02	25
	Administrative staff	02	-	01	3
BRAC	Faculty	09	0	03	12
	P. graduate students	15	0	04	19
	Graduate students	16	-	03	19
	Administrative staff	05	0	02	07
BUIT	Faculty	15	-	05	20
	P. graduate students	10	01	03	14
	Graduate students	10	05	-	15
	Administrative staff	03	02	02	07
EWU	Faculty	13		05	18
	P. graduate students	11	02	04	17
	Graduate students	13	03	09	25
	Administrative staff	06	-	02	08
	Total	**192 (60.6%)**	**45(14.1%)**	**76(24.0%)**	**317**

Barriers faced by the respondents

The respondents were also asked about the difficulties they faced in their library. The result described in Table-6shows that most of the respondents 16(5.04%)claimed that lack of professional staff was the main barrier faced by them while 120(37.85%) respondents stated that the library had inadequate learning resources for their users. Moreover, 74(23.34%) and 48(15.14%) of the respondents revealed that they had a shortage of time to access the library resources and the library had insufficient infrastructural facilities respectively. On the other hand, the study conducted by Haridasan and Khan (2009) found that faculty members had faced difficulties such as internet access problems while searching online databases. Dukic (2013) found another barrier, namely, limited access to full-text databases in a Croatian university.

Table 6:Barriers faced by the respondents

Univ.	Categories of respondents	Obstacles						Total
		Inadequate learning resources	Shortage of time	Insufficient infrastructural facilities	Lack of knowledge	adequate space	Lack of professional staff	
NSU	Faculty	05	-	05	-	10	-	20
	Postgraduate	10	02	05	-	05	-	22
	Graduate	30	-	-	02		03	35
	Administrative staff	05	-	-	-	-	-	05
EU	Faculty	05	03	-	-	-	-	08
	P. graduate students	10	05	03	-	-	-	18
	Graduate students	05	05	0	05	05	05	25
	Administrative staff	-	03	-	-	-	-	3
BRAC	Faculty	05	07					12
	P. graduate students	05	06	04	03		01	19
	Graduate students	13	02	-	04	-	-	19
	Administrative staff	-	03	-	-	-	-	07
BUIT	Faculty	05	12	03	-	-		20
	P. graduate students	04	02	04	02	-	02	14
	Graduate students	06	02	-	04	-	03	15
	Administrative staff	-	07	-	-	-	-	07
EWU	Faculty	05	10	03	-	-	-	18
	P. graduate students	07	05	03	-	-	02	17
	Graduate students	10	-	10	05	-	-	25
	Administrative staff	-	-	08	-	-	-	08
Overall total		**120 (37.85%)**	**74(23.34%)**	**48(15.14%)**	**25(7.88%)**	**20(6.3(%)**	**16(5.04%)**	**317**

Recommendations

The study indicates that the need for information as well as user satisfaction vary from client to client and library to library. The library authority should take significant actions for satisfying the users by providing them essential resources in order to enhance the efficiency of searching and proper utilization of the resources. Based on the survey findings and literature review, the researchersof this study put forward the following suggestions to improve the performance of the library:

- The academic library should regularly develop their collection according to the users' information needs and preferences.
- Sufficient resources can make the user satisfied and increase their habit of using library resources regularly. Sriram and Rajev (2014) stated that academic libraries should offer various facilities and services that support to satisfy users' needs.
- Academic libraries must deal with the difficulties and train up the users so that they can utilize the library services optimally.
- Library and information professionals should work tirelessly to improve the library services and ensure easy access to information by the library users. They should also try to deliver updated services for saving the time of the users.
- To disseminate the required information services to the user, the library personnel should meet the emergency needs of the users proficiently.
- Academic libraries in Dhaka city should have adequate infrastructural facilitiesand state-of-the art technologies for keeping the library environment resourceful and attractive.
- Skilled professionals should be hired and trained and supportive staff should be retained for providing greater facilities to the users.
- Library authority should organize user information sessions, workshops, webinars, etc., to help users avail themselves of the library resources and services.
- The library should be allocated sufficient budget to purchase recent books, journals, periodicals and equipment and to develop infrastructural facilities.

Additionally, modern library automation systems and institutional repositories should be put in place to maximize the use of library's resources. University libraries should be equipped with sophisticated IT facilities, and library staff also should be proficient in advanced technologies so that they can provide and maintain better services. Habiba and Ahmed (2020b) found that large university libraries and many private university libraries in Bangladesh had adequate IT facilities.

Conclusion

Library resources, library services, and users are the most integral part of any library. User feedback is a substantial determinant in evaluating the efficiency and effectiveness of the library. A library's mission will be never fulfilled if the users are not satisfied with the resources and services that the library provides. An Academic library is a much needed platform for disseminating information as it attempts to store as many resources as possible on various disciplines. The current study was performed on some selected private universities in Dhaka city. University libraries are facing many challenges for providing information in this digital era, which is highly competitive and is rapidly changing.Therefore,academic libraries need to have enhanced facilities andbetter servicesfor delivering information resources successfully to the users. This research attemptedto show that the satisfaction of the users depends on the collections, services and infrastructure of the library as well as on experienced and trained personnel, goodlibrary environment,positive attitude of the authority, proper arrangement of library resources, sufficient budgetary allocation and use of information technology. The study finally put forwardsome recommendations for satisfying users' information needs to fill up the gaps between users' expectations and the services offered. If the university libraries follow these recommendations, the gaps will be minimizedand users will receive effective and efficient services from the academic libraries.

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Appendix

Evaluating the User Information Need and Satisfaction Level on Selected Academic Library Sources and Services, Bangladesh

1. Demographic information

1.1 Name of the university……..

1.2 Category of the user

- Faculty members
- Administrative staff
- Postgraduate students
- Graduate students

1.3 Gender of the respondents

- Male
- Female

2. How often do you visit library?

- Daily
- Once in a week
- Twice in a week
- Three times in a week
- Occasionally

3. Would you please indicate the purposes of the library visit? (Check all that apply)

- General books
- For research purpose
- Periodical articles
- Using IT facilities
- Recreation
- Teaching materials

4. Would you please indicate the type of information sources and services used in the library? (Check all that apply)

- Books
- Journals
- CAS& SDI services
- Reference & referral services
- Reprographic services
- Indexing & abstracting services
- Audio-visual services
- Bibliographic services

5. What types of searching tools do you use while searching library materials? (Check all that apply)

- Shelf search
- Card Catalogue
- OPAC
- Library staff
- Full-text library database

6. Would you please indicate your level of satisfaction with the information resources and services provided by the library?

- Fully satisfied
- Partially satisfied
- Dissatisfied

7. Would you please mention the obstacles that you are faced in using the library sources and services?(Check all that apply)

- Inadequate learning resources
- Shortage of time
- Insufficient infrastructural facilities
- Lack of knowledge
- Adequate space
- Lack of professional staff

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The papers should follow the Harvard referencing style, updated

For book	Surname Initials (year) *Title of Book*, Publisher: Place of publication. De Landa, M. (1997). *A Thousand Years of Nonlinear History*, Zone Books: New York.
Edited book	Editor surname(s), initial(s). (eds.) (Year Published). Title. Ed, Place, publisher William, S.T. (eds). (2015). *Referencing: a guide to citation rules*. 2nd ed. New York: Elsevier
Chapter-edited Book	Troy B.N. (2015). Harvard citation rules. In Williams, S.T. (eds). *A guide to citation rules*. New York: NY Publisher, pp.40-50
For Journal (Printed)	Surname, Initials (year) 'Title of article', *Journal Name, Volume, number page.* Dent, V.F. (2007). Local economic development in Uganda and the connection to rural community libraries and literacy, *New Library World,* 108(6), 203-17.
Journals (online)	Mitchell, J.A. (2017). How citation changed the research world. *The Mendeley*, 62(9) (issue/season) [Online] Available at http://archive .ifla.org/IV/ifla70/papers/0le-Makenzi.pdff [Accessed 11 April 2011]
Conference paper	Hockman, J., Southall, C. and Stables, R. (2017). Automatic drum transcription for polyphonic recordings using soft attention mechanisms and convolutional neural networks. *The 17th International Society for Music Information Retrieval (ISMIR2016) Conference*. New York, 7-11 August 2016, pp. 591-597. Available at http://archive .ifla.org/IV/ifla70/papers/0le-Makenzi.pdff (Accessed: 11 April 2011)

Conference proceedings	Boultwood, A. and Hindle, S., eds. (2018). *Culture, Costume and Dress: Proceedings of the 1st international conference*. Birmingham City University, 10-12 May 2017. Birmingham: Gold Word Publishing. Available at http://archive .ifla.org/IV/ifla70/papers/0le-Makenzi.pdff (Accessed: 11 April 2011)
Newspaper article	Surname Initials (year) 'Article title*', Newspaper, date, pages* Islam, M. S. (2012). Arresting Regulatory failure in the Financial System, *The Daily Star,* 31 August, 14.
Electronic sources/ Website	If available online, the full URL should be supplied at the end of the reference, as well as a date that the resource was accessed. Makenzi, M. (2004). Reaching out to the less advantaged: reading tents in Kenya' [Online] Available at http://archive.ifla.org/IV /ifla70/papers / 0le-Makenzi.pdff (Accessed: 11 April 2011)
Reference with no Date	Simply state 'no date' in place of the year e.g., Mitchell (n.d.)
No author	If possible, use the organization responsible for the post in place of the author. If not, use the title in Italics *A guide to citation*, 2017, pp. 189-201) AFP (2017) A guide to citation, pp. 189-201)