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Challenges and prospects of linked data technology initiative in Bangladesh Libraries: A quantitative study

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Abstract

Background of the study: The mission of libraries is to collect, organize, and make available various forms of information resources for potential users. Many libraries and historically significant institutions have rare and credible information resources that have little use because few people know they are available online.

Purpose: The primary objective of this study is to ascertain the challenges and potential advantages associated with implementing Linked Data (LD) technology in libraries in Bangladesh.

Method: A quantitative survey was conducted to collect data from the library professionals of some selected public university libraries in Bangladesh.. A total of 39 responded to the survey, which was usable among the 54 responses. The response rate was 72.2%. Once the quantitative data were collected, data were transferred into IBM®SPSS® statistics for analysis.

Findings: The survey's results show that academic librarians are thoroughly aware of LD technology and believe they could have many advantages. Current research found that library professionals understand the challenges of adopting LD technologies in Bangladesh's libraries.

Conclusion: This research is the first empirical investigation of the topic within the Bangladeshi setting that the authors are aware of. It shows how the information professionals in Bangladesh see the library LD and related initiatives and the possible advantages of putting it into action.

Keywords: Linked data, Semantic Web, Libraries in Bangladesh, Challenges and prospects.

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Introduction

Linked Data (LD) is an emerging framework comprising technologies and principles that may enable information environments, such as libraries, to publish and connect their concealed data on the internet, thereby facilitating global accessibility. The mission of libraries is to collect, organize, and make available various forms of information resources for potential users. Many libraries and historically significant institutions have rare and credible information resources that have little use because few people know they are available online. Moreover, the nature of data is getting more complicated, which makes it difficult for libraries to manage and share vast amounts of data sets in a helpful way.

Individuals tend to depend on the Internet as their primary information source when seeking specific needs. They search for pertinent information using the search engines Google, Yahoo, and Bing in addition to various databases. Nevertheless, libraries' online presence is limited in its ability to aid those who use them. Although libraries possess dependable information resources, users do not have access to them via the Internet. Libraries now have an incredible opportunity to publish and link their data on the Internet using LD technology (Warraich et al. 2022). Libraries have a wealth of knowledge and information that is waiting to be discovered, among other things by using the recently developed concepts of LD (Winer, 2014). For this, several initiatives were undertaken by libraries in order to put LD concepts into practice (Hanson, 2014). LD technology presents an incredible opportunity for libraries to share and connect their online resources. According to Shiri and Davoodi (2016), LD is characterized by its consistency, interoperability, and share-ability, which enable connections to be made between structured entities and to publish these entities on the World Wide Web. Through LD efforts, libraries have the opportunity to enhance their digital visibility and facilitate information retrieval (Raza et al., 2019; Hallo et al., 2016). By establishing links between topics, individuals, locations, and other open objects that are connected, it is possible to improve the retrieval of material (Mi and Pollock, 2018). Cagnazzo (2017) highlighted the benefits that LD may provide in terms of enhancing the discoverability and visibility of library data, as well as facilitating interoperability and removing language barriers. In another study, Landis (2019) underlined the need for positive and efficient examples of LD usage that might best assist and urge libraries to follow the Web of Data principles.

Moreover, LD allows access to broader audiences, it can show vocabularies hierarchically and create associations among objects and linking data to other data sets provides context for interpreting data (Ryan et al., 2015; Debruyne et al., 2016). Metadata from a specific library can be used by other libraries and organizations, which is advantageous for other library applications. Resources can be linked with other library resources and organizations using Linked Data (LD), which can be useful for migration purposes in archives and digital libraries. After an LD technology is completed, there is reduced reliance on the IT team. The successful completion of LD initiative with a small staff and a short time frame can serve as motivation for future initiatives (Rademaker et al., 2015; Hanson, 2014).

Bangladesh is a developing country, and over the years, there has been a notable emergence of an information society within the country, leading to a transition of traditional services across several domains into electronic formats. This movement encompasses areas such as e-learning, e-library, and e-government. In this digital world, users of academic libraries have high expectations, and information professionals come up with various ways to make useful information easy to find and access. LD has the potential to be employed in libraries as a technology that can enhance accessibility for academics from diverse backgrounds. Although numerous advantages of LD, such as enhanced digital visibility, improved information retrieval, and increased interoperability, there is a lack of focused studies on the challenges and practical prospects of implementing LD technology in libraries of

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developing countries, such as Bangladesh. There is a significant gap in understanding the unique challenges that libraries in developing regions face, such as limited technological infrastructure, budget constraints, and lack of trained personnel. Therefore, this research aims to fill the gap by conducting a quantitative study that explores both the challenges and prospects of LD technology initiatives in Bangladeshi libraries. Considering this issue, this study aims to undertake a study on the challenges and prospects of LD technology initiatives in libraries in Bangladesh. The purpose of this research is to analyze Linked Data awareness and expertise among Bangladeshi library professionals, as well as to evaluate the existing preparedness and utilization of this technology. It will highlight perceived benefits, such as better resource discovery and metadata management, as well as technical and organizational challenges such as data integration and budgetary constraints. The study will examine deficiencies in abilities and training requirements before making recommendations for continued professional development. By comparing worldwide practices, the research will provide practical methods and policy suggestions for using Linked Data in Bangladeshi libraries. Finally, it will assess the possible influence on library services and customer satisfaction, establishing indicators for success. By doing so, it will contribute valuable insights into how LD can be effectively integrated into library systems in developing countries, and what specific strategies can overcome the existing barriers to its implementation. The results of this study will also assist information specialists and authorities in putting LD technology into libraries. It might also prompt further research to gain a deeper comprehension of the difficulties faced by information workers, enabling the implementation of advocacy and training initiatives that will support LD efforts in libraries in Bangladesh.

This research aims to identify the challenges and prospects of the LD technology initiative in Bangladeshi libraries. To achieve this aim, the following research questions were developed:

RQ1. What are the perceptions of librarians regarding the prospects of LD usage in libraries?
RQ2. What are the benefits of LD application in Libraries?
RQ3. What are the obstacles to implementing and applying LD technology in libraries?

Literature review

Consistency, interoperability, and shareability are characteristics of LD that enable links between organized entities and make these entities publicly available on the Web (Shiri & Davoodi, 2016). LD essentially uses the Web to establish typed links between data from various sources. In a technical sense, it pertains to data that is made available on the World Wide Web in a manner that enables machines to interpret it. Wood et al. (2014, p3) defined LD as "Linked Data is a set of techniques to represent and connect structured data on the web…Linked Data makes the World Wide Web into a global database that we call the Web of Data". In order to improve content retrieval, links are established among topics, individuals, locations, and other open entities (Mi & Pollock, 2018).

Due to LD's complexity and extensive scope, many individuals struggle to comprehend its technical details and potential for the library community. LD technologies have been deployed by the Library of Congress, the Online Cataloguing and Lending Centre (OCLC), and national libraries of other nations (Wang & Yang, 2018). Three components make up LD technologies: RDF, ontology, and query language. LD is founded upon the utilisation of the hypertext transfer protocol (HTTP), unified resource identifiers (URI), and the application of Semantic Web standards, notably the resource description framework (RDF). This framework facilitates the establishment of connections between associated data sets and other pertinent resources.

Integrating LD technologies within the information service domain has significantly

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transformed the bibliographic standards and models employed, shifting from Anglo-American Cataloguing Rules, 2nd ed. (AACR2) to Resource Description and Access (RDA) and Bibliographic Framework (BIBFRAME). BIBFRAME was created to replace Machine Readable Cataloguing (MARC) standards and to make bibliographic data more useful by employing LD principles. However, the emergence of technologies like schema.org and RDF triples has prompted the Library and Information Science (LIS) community to enhance the visibility of their extensive information resources on the internet (Warraich & Rorissa, 2018). The possible benefits of incorporating LD in libraries and its influence on users are significant. Wang et al., (2018) stated that LD has many benefits, such as allowing internet search engines to get library materials and releasing bibliographic data from silos into the Web. It can also connect to library resources from other communities

However, it is essential to acknowledge the numerous problems and challenges associated with its implementation (Gonzales, 2014). Literature has shown that libraries are having trouble implementing LD technologies because there aren't enough ways to share library LD, practical tools to improve information quality before RDF implementation, value-added services, and authority files (Hidalgo-Delgado et al., 2019). There has been a concerted effort by libraries to convert their bibliographic data to the LD format necessary for the Semantic Web. The path is complex, and progress is slower than expected. One explanation is that LD is relatively new to libraries and represents a significant shift from cataloging as usual. Several technical details must be resolved before implementing the new procedure in a production setting. Currently, the testing and development of LD initiatives are primarily undertaken by large libraries and organizations that possess the necessary technological competence and financial resources. Library of Congress (LC), Online Computer Library Centre (OCLC), and other national libraries have pioneered library-LD initiatives (Warraich & Rorissa, 2020). The vast majority of tiny libraries are merely spectators. There is a scarcity of prototypes that effectively illustrate the advantages of utilising library data as LD. Moreover, one of the obstacles to posting library data online, according to Gonzales (2014), is the complexity of copyright rules and regulations. Since libraries cannot use LD technologies until digital preservation systems and Web servers are developed, this presents a problem with the technological infrastructure. Additionally, many librarians struggle to conceptualise the appearance and functionality of a prospective Semantic catalogue. Transforming the vast amount of data, encompassing about four decades of catalogued information into linked data is a considerable challenge. The development of library vocabularies and ontologies is a multifaceted and time-consuming process.

Developed countries are far more likely to take the initiative to integrate LD technology than developing countries. The Library of Congress (LOC) BIBFRAME project, the LD for Libraries project, and the OCLC project are the initiatives libraries take in Europe and North America. Cornell University Library, Harvard Library Innovation Lab, and Stanford University Libraries were among the first academic libraries to implement LD initiatives (Warraich & Rorissa, 2020). "LD for Production" (2016–2018) is a project that Columbia University, Princeton University, and the LOC are working on together. This initiative aims to establish a framework encompassing infrastructure, standards, and guidelines for the joint creation of metadata in the form of linked open data (Branan & Futornick, 2017). Europeana, the Digital Public Library of America, the National Library of France, the National Library of Spain, the LOC, and the British Library have all utilized linked data technologies to publish online resources (Hallo et al., 2016). However, despite the challenges libraries worldwide have chosen to adopt LD as a viable approach and have achieved significant advancements in its implementation (Wang & Yang, 2018). Information professionals have the opportunity to participate in a wide range of seminars, training sessions, and workshops in order to improve

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their knowledge and abilities about the use of LD technology in lending libraries (Pennington & Cagnazzo, 2019).

Libraries, both public and academic, in less developed nations have historically lacked access to a variety of automated services. The cost of hardware was expensive and remains relatively pricey for developing nations. Another issue rarely discussed is the requirement for collaboration inside and between institutions to launch and manage a library automation project. Because of all these issues, there are few initiatives on the application of LD technology in libraries on this Asian continent, especially in developing countries like Bangladesh. Users of academic libraries in Bangladesh have high expectations in this digital age, and information workers create various plans to ensure that pertinent content is easily accessible. Therefore, libraries must employ LD as a tool to improve accessibility for scholars from multiple backgrounds. However, no study has been undertaken to demonstrate the extent of librarians' interest, prospects, and the problems they experience in adopting LD technology in libraries in underdeveloped countries like Bangladesh. Based on this literature gap, this research tries to solve the gaps using the following research objectives and questions.

Method

Research Design

To understand the use of LD in Bangladeshi libraries, a quantitative survey was carried out to collect data from the library professionals of some selected public university libraries in Bangladesh.

Population and Sample

For the present study, the targeted respondents were library professionals from five public university libraries in Bangladesh. Convenience sampling was selected based on the research objectives. The selected university libraries were Dhaka University Central Library (DUCL), Rajshahi University Central Library (RUCL), Bangladesh University of Engineering and Technology Library (BUETL), Shahjalal University of Science and Technology Library (SUSTL), Chittagong University of Engineering and Technology Library (CUETL), Sylhet Agriculture University Library (SAUL), and Jessore University of Science and Technology Library (JUSTL). Thirty printed questionnaires were distributed among the deputy librarians, assistant librarians, and junior librarians of DUCL. Google Forms (https://forms.gle/JbfLbWQGhDsmPABr9) links were sent to 24 of the other selected university libraries by sending links to Facebook Messenger. The survey began in early October 2023 and ended in November 2023. A total of 39 usable responses from the survey (printed and Google form link) were used for data analysis among the 54 respondents. The response rate was 72.2%.

Data Collection and Analysis

In this study, the instruments that were used to collect data were printed questionnaires and Google Forms. The first section of the questionnaire describes the demographic information of the respondents. In developing the questionnaire, we adopted some of the survey items from previous studies, and some were self-developed. Both open- and close-ended questions were included in the questionnaire. The questionnaire also used a five-point Likert scale to gather responses from the library professionals. Once the quantitative data were collected, data were transferred into IBM®SPSS® statistics for analysis.

Ethical Considerations

Moral consent was also accomplished by using a standardized informed consent

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declaration which was included in the questionnaire. Therefore, the morality of secrecy of information given by the respondents was rigorously confidential. No participant was compelled to contribute data and information against their will. In addition, participants were given a detailed explanation of the research's primary goal. Furthermore, the study's sources were adequately cited and referenced.

Result and Discussion

The following section presents the findings of the investigation.

Variables, Coding, and Items of the Questionnaire

The measurement items and variables were developed from prior studies to ensure the validity of the research. The variables, coding, and items are listed in Table 1.

Table 1. Variables, Definitions of the variables, and Coding and items statements

Variables	Definitions of the variables	Coding and items statements
Implementing LD Standards (ILDS)	LD standards implementation will improve libraries' and information professionals' ability to change information management to satisfy users' information needs.	ILDS1= Librarians ought to enhance their capacities to grasp bibliographic standards. ILDS2= Software-related expertise, such as Open Refine, is required for LD applications in libraries. ILDS3= Professionals should improve their technological abilities via self-learning and, with the help of peers, incorporate LD technology into their libraries. ILDS4= Incorporating LD could enhance librarians' abilities and assist in building user-centered services efficiently. ILDS5= Experts should develop their abilities to convert unstructured data into structured data.
LD Technology Implementation (LDTI)	Perceptions about LD technology implementation in libraries	LDTI1= Improve the ability to move between the conventional online tools that are used to access library materials and the wider environment of the World Wide Web. LDTI2= The forthcoming standard for generating metadata and records for library information resources management. LDTI3= Adopted by libraries and their online portals as a standard for managing information resources LDTI4= AACR2 is likely to be replaced by RDA LDTI5= Contributes limited value to the enhancement of information resources management in libraries and the services they provide.

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Adopting LD Technology (ALDT)	Considering implementing LD technology in libraries shortly	ALDT1= Is developing a strategy for generating bibliographic entries. ALDT2= Has intends to develop bibliographic records ALDT3= Has started an approach to generate bibliographic data. ALDT4= Has developed a plan for making bibliographic records that includes LD standards, however, the approach hasn't been put into action yet.
Benefits of LD (BLD)	The potential benefits of LD	BLD1= Directness and exchange of metadata content BLD2= Enable the unexpected exploration of knowledge resources BLD3= Identifying patterns in the use of resources BLD4= Create a navigation BLD5= Metadata improved with links
Challenges of LD Implementation (CLDI)	The challenges of LD implementation in the library	CLDI1= The use of LD technology in libraries is now in its early stages and lacks sufficient evidence of its effectiveness. CLDI2= Integrating LD technology in libraries involves technological challenges. CLDI3= For libraries, the implementation of LD technology would be prohibitively expensive. CLDI4= Lack of guidelines regarding how to implement LD in libraries CLDI5= Inadequate competencies among library employees CLDI6= Insufficient knowledge of the underlying concept of LD principles among library personnel

Participants' Demographic Information

Table 2 highlights the demographic information of the respondents. There were 28 male (71.8%) and 11(28.2%) female participants, illustrating the challenges and prospects of LD in libraries. The table also shows that among the respondents, 21 (53.8%) were deputy librarians, 15 (38.5%) were assistant librarians, and only 3 (7.7%) were junior librarians. Most of the respondents have an M.A. degree (32, 82.1%), only a few of them have an M.Phil. (5, 12.8%), and 2 (5.1%) have a Ph.D. The respondents' demographic information shows they have good knowledge and higher educational degrees in their profession.

Table 2. Demographic Profile of the Respondent

Demographic	Frequency (N=39)	Percentage (%)
Gender		
Male	28	71.8
Female	11	28.2

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Designation		
Deputy Librarian	21	53.8
Assistant Librarian	15	38.5
Junior Librarian	3	7.7
Level of Education		
M. A.	32	82.1
M.Phil.	5	12.8
Ph.D.	2	5.1
Total	39	100

Source: Primary data from 2023.

Respondents' Familiarity with LD Concepts

This question aimed to determine how well information professionals thought they understood LD's fundamental ideas and terms. Data from the table shows that many respondents were familiar with LD (25,64.1%), whereas only a few had good knowledge of LD (3;7.7%). The table also shows that only 6 (15.4%) have heard about LD, but it has been a challenge for the respondents to understand, followed by 5 (12.8%) who have heard but are not exactly sure of the concept (Table 3).

Table 3. Familiar with the term LD

	Frequency (N=39)	Percentage (%)
I have heard but I am not exactly sure of the concept	5	12.8
I have heard, but it has been a challenge for me to understand	6	15.4
I am familiar with LD	25	64.1
I have good knowledge of LD	3	7.7
Total	39	100

Source: Primary data from 2023.

Library professional's potential and capability to implement LD standards

This construct evaluated information professionals' perceptions of library LD initiatives with five statements. The response to this statement was measured from 1 (Strongly Disagree) to 5 (Strongly Agree). These claims are reliable with a Cronbach's Alpha of 0.857. Table 4 shows that respondents believe LD would improve librarian skills and enable user-centric services with the highest mean value of 4.13 (SD=.767) followed by professionals should increase their technical expertise via self-study and integrate LD technology into library settings (Mean=4.10; SD=.788). Expertise in software, such as Open Refine, is required for LD applications in libraries, obtaining the lowest mean value of 3.90 (SD=.821).

Table 4. Library professional's potentiality and capability to implement LD standards

Statements	Mean (SD)
Implementing LD would enhance the capabilities of librarians and facilitate the creation of user-centric services	4.13 (.767)
Professionals should increase their technical expertise via self-study and integrate LD technology into library settings	4.10 (.788)
Professionals should concentrate on improving their abilities to turn unstructured data into structured data	4.08 (.739)
Librarians need to improve their knowledge of bibliographic standards	3.92 (.839)

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Expertise in software, such as Open Refine, is required for LD applications in libraries	3.90 (.821)

Source: Primary data from 2023.

Respondent's Judgement of the Present Situation of the Library for LD Initiative

Findings in Table 5 indicate that most of the respondents have confidence that the present ICT infrastructures are adequate to provide LD technology-related services in the libraries 24 (61.5%). 11 (28.2%) replied that they were not sure, and only 4 (10.3%) replied negatively about the statement. The findings in Table 5 indicate that most respondents responded positively, i.e., 16 (41%), that the present manpower is skilled enough to provide LD technology-related services in the library. Among the respondents, 15 (38.5%) replied negatively, followed by not sure (8, 20.5%) regarding the statements. Respondents were also asked that a library should spend on LD initiatives. Many participants, 30 (76.9%), agreed with the statement. Among the respondents, 9 (23.9%) said they were not sure regarding the statement.

Table 5. Respondent's judgment of the present situation of the Library for LD initiative

Statements	Frequency (N=39)	Percentage (%)
Would you please state whether the present ICT infrastructures are adequate to provide LD technology-related services?		
Yes	24	61.5
No	4	10.3
Not sure	11	28.2
Do you think your present manpower is skilled enough to provide LD technology-related services in your library?		
Yes	16	41.0
No	15	38.5
Not sure	8	20.5
In your opinion, should a library spend on LD initiatives?		
Yes	30	76.9
Not sure	9	23.1
Total	39	100.0

Source: Primary data from 2023.

Respondents' Perceptions of the Adaptation of LD Technology in Libraries

This concept measured information professionals' perceptions of LD projects in libraries using five assertions. On a five-point Likert scale, 1 represents strongly disagree and 5 represents strongly agree with this statement. These assertions have a Cronbach's Alpha rating of 0.757, which indicates that the items have good dependability. Table 6 shows that respondents believed AACR2 would likely be replaced by RDA, with the highest mean value of 5.03 (SD=1.276). Improve the ability to move between the conventional online tools that are used to access library materials and the broader environment of the World Wide Web with a second highest mean value of 3.82 (SD=.970) and the forthcoming standard for generating metadata and records for library information resources management obtain the same mean value of 3.82 (SD=.942). They also considered that " Adopted by libraries and their online portals as a standard for managing information resources and Contributes limited value to the

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enhancement of information resources management in libraries and the services they provide with a 3.74 (SD=.910) and 3.72 mean (SD=.999), respectively. According to these results, they were persuaded of the value of LD technology in an information environment.

Table 6. Perceptions about LD technology in libraries

Statements	Mean	SD
AACR2 is likely to be replaced by RDA	5.03	1.276
Improve the ability to move between the conventional online tools that are used to access library materials and the wider environment of the World Wide Web	3.82	.970
The forthcoming standard for generating metadata and records for library information resources management	3.82	.942
Adopted by libraries and their online portals as a standard for managing information resources	3.74	.910
Contributes limited value to the enhancement of information resources management in libraries and the services they provide.	3.72	.999

Source: Primary data from 2023.

Libraries have any plans to adopt LD technology in your libraries soon

It is essential to look into how much planning they have done to include LD in libraries. This construct has four statements to explore their plans. This statement was measured on a five-point Likert Scale from 1=Strongly Disagree to 5= Strongly Agree. The Cronbach's Alpha value of these statements is 0.864, showing good reliability of the items. Table 7 shows that all the statements have more than three mean values. Overall, mean values ranged from 3.79 to 3.33 on the five-point scale highlighting the moderate level of planning to adopt LD technology in libraries. However, their library intended to develop bibliographic records that obtained the highest mean value (Mean 3.79; SD=.767), followed by an approach to generate bibliographic data (Mean=3.69; SD=1.034). Develop a strategy for generating bibliographic entries and develop a plan for making bibliographic records that includes LD standards; however, the approach hasn't been put into action yet, with 3.49 and 3.33 mean values, respectively. According to the data, libraries were in the preliminary stages of developing strategies to integrate LD standards. The value of SD in the table indicates that their perspectives on developing a strategy to implement LD standards in libraries were consistent.

Table 7. Plans to adopt LD technologies in libraries

Statements	Mean	SD
Has intends to develop bibliographic records	3.79	.767
Has started an approach to generate bibliographic data	3.69	.922
Develop a strategy for generating bibliographic entries	3.49	.942
Has developed a plan for making bibliographic records that includes LD standards; however, the approach has not been put into action yet	3.33	1.034

Source: Primary data from 2023.

Potential benefits of LD technology in libraries

This construct comprised five statements that investigated the perceived possible advantages of LD technology implementation in libraries as considered by information professionals. A five-point Likert Scale was used to rate the statement, with 1=Strongly Disagree and 5=Strongly Agree. The statements have a Cronbach's Alpha score of 0.934, indicating a high level of dependability for the items. Respondents saw the potential usefulness

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of LD. The metadata was enhanced by including connections that have the greatest average value (Mean=4.08; SD=.957). The data indicates that the creation of navigation achieved a mean score of 3.92 with a standard deviation of 0.900, placing it in second place in terms of the potential advantages of LD. Following closely behind is the identification of resource utilisation patterns, which earned a mean score of 3.85 with a standard deviation of 0.779. The other two assertions have an approximate mean of 3.67, which is considered a favourable mean value. Table 8 demonstrates a consensus among all individuals about the efficacy of LD in library setups.

Table 8. Potential benefits to implementing LD technology in libraries

Statements	Mean	SD
Metadata improved with links	4.08	.957
Create a navigation	3.92	.900
Identification of resource usage patterns	3.85	.779
Facilitate the unexpected discovery of information resources	3.67	1.034
Metadata directness and sharing	3.67	.955

Source: Primary data from 2023.

Obstacles to Implementing LD Technology in Libraries

Participants were questioned on the perceived obstacles to integrating LD technology in libraries. This concept consists of six statements that are rated on a 1-5 Likert scale, with 1 representing "Strongly Disagree" and 5 representing "Strongly Agree". The reliability statistics for these six statements indicate that Cronbach's Alpha is 0.931. It is considered to have a high level of dependability. Responses varied in relation to perceived barriers to using LD technology in libraries. Six statements on obstacles to investigating LD technologies were presented to survey respondents, who were asked to indicate on a five-point Likert scale whether they agreed or disagreed. The statement insufficient knowledge of the underlying concept of LD principles among library personnel had the lowest Standard Deviation (.778) and the highest mean rating of 3.97 from the respondents (1.321). At the same time, inadequate competencies among library employees obtained the second mean value of 3.90 (SD=.995), followed by integrating LD technology in libraries involves technological challenges (Mean=3.82; SD=.942), and the use of LD technology in libraries is now in its early stages and lacks sufficient evidence of its effectiveness (Mean=3.67; SD=.955).

Table 9. Obstacles to Implementing LD Technology in Libraries

Statements	Mean	SD
Insufficient knowledge of the underlying concept of LD principles among library personnel	3.97	.778
Inadequate competencies among library employees	3.90	.995
Integrating LD technology in libraries involves technological challenges	3.82	.942
The use of LD technology in libraries is now in its early stages and lacks sufficient evidence of its effectiveness	3.67	.955
Lack of guidelines regarding how to implement LD in libraries	3.51	1.023
For libraries, the implementation of LD technology would be prohibitively expensive	3.46	1.022

Source: Primary data from 2023.

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Discussion

The primary objective of this study is to examine the perspectives of university library professionals in Bangladesh regarding the implementation of LD technologies. Additionally, it sought to assess the level of comprehension among library professionals regarding LD concepts, as well as their strategies and initiatives for implementing such technologies and the advantages they offer. The results of this survey indicated that academic librarians have an adequate understanding of the potential advantages of LD technologies and a favourable opinion of their value.

The research RQ1 was what are the perceptions of librarians regarding the predictions of LD usage in libraries? The research found that survey participants understood the LD concept well. It is important to note that the respondents' perception and understanding of LD terms were self-reported and were not cross-checked. The research showed that respondents were persuaded of the value of LD technology in an information environment. They were moderately familiar with the LD technology. Findings from the research indicated that the respondents believe that implementing LD would enhance the capabilities of librarians and facilitate the creation of user-centric services. Professionals should increase their technical expertise via self-study and integrate LD technology into library settings. The results of the study implied that most of the respondents have confidence that the present ICT infrastructures are adequate to provide LD technology-related services in the libraries. The results of this study are in line with the results of the Warraich & Rorissa study (2020). They found that Pakistani information professionals were familiar with the core concepts of LD technology, and the respondents also deemed that RDA would soon replace AACR2.

The research RQ2 was what are the benefits of LD application in Libraries? The study found that respondents obviously thought that LD could be useful metadata improved with links, which was the major benefit of LD implementation in the library. The study also showed that creating navigation and the identification of resource usage patterns were the other significant benefits of LD applications. The research also found that LD can enhance users' overall search experience with current library catalogues. Respondents were positive about LD's potential benefits for libraries, believing that LD technology will be cost-effective for patrons to make efficient use of library resources. The majority of the Respondents also replied that the library should spend on LD initiatives for the betterment of the library services.

The research RQ 3 was what are the obstacles to implementing and applying LD technology in libraries? According to the research findings, libraries were in the preliminary stages of developing strategies to integrate LD standards but it is a positive sign that libraries' perspectives on developing a strategy to implement LD standards in libraries were consistent. The research found that lack of awareness of the basic concepts of LD among library professionals, and lack of skills are the major obstacles to implementing and applying LD technology in libraries. The outcomes of the study corroborated those of Ali and Warraich (2018). They explained that obstacles to LD adoption in the information environment include technology, shortage of trained staff, lack of awareness, license issues, the unavailability of standards, less experience and practices. It takes specialists to implement the sophisticated LD technologies in these libraries. For this goal, librarians may also be educated to implement LD technologies in their digital libraries (Raza et al., 2019). According to Hannemann and Kett (2010), significant improvement of the technical infrastructure is necessary. This infrastructure consists of a web server, a digital preservation system, and a resolver that promptly and accurately identifies inquiries.

Conclusion

This study adds to the body of literature by examining obstacles to LD implementation

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in libraries and methods to improve data and information retrieval in an LD setting. The administration of libraries may need to consider its effects when integrating LD technology. The problems, obstacles, and restrictions associated with implementing LD technology in libraries will be known to library professionals. They will have a better understanding of how to use LD technologies.

This study's primary aim was to investigate library professionals' perspectives and the possible advantages of LD technologies in libraries in Bangladesh. The study results demonstrate that academic librarians possess a strong comprehension of LD technology and recognize their potential advantages. Recent analysis has shown that library professionals in Bangladesh had a comprehensive understanding of the difficulties associated with using LD technologies in libraries. Results indicated that Bangladeshi library professionals were still not using LD in libraries. They grasp LD technology to a reasonable extent. Regarding the possible advantages of integrating LD technology in libraries, the respondents were upbeat. In general, the planning stages of the respondents' institutions varied, ranging from developing a plan to having one that was complete. Their knowledge of the importance of LD technology is predicted to lead to the effective implementation of LD technology in libraries, even though their institutional plans are still in the early stages of development. The Bangladeshi library community would benefit greatly from the study's conclusions. Additionally, this study will help planners of LD technologies in libraries understand the possible advantages of their successful implementation.

Limitations and Future Research Scope

There are a few limitations to this research. In particular, the population was selected on a selective basis. Second, it has been shown that the respondents' understanding of LD concepts and opinions on its adoption and potential benefits in libraries are largely uninformed.

In order to improve the user focus of the LD practice, further research is needed. It's a quantitative study, and it serves as the starting point for future studies. In order to explore this phenomenon, however, it is necessary to carry out more detailed qualitative studies in the ICT environment. In future studies, the potential of LDDBpedia, VIAF and Open Library to retrieve information should be explored as these sources have much fewer failed searches compared with online catalogue databases. A more pragmatic roadmap for implementing Learning and Development in Bangladesh's libraries can be proposed by future studies.

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Authors' Contributions

All authors have contributed to the final manuscript. The contribution of all authors: conceptualization, methodology, formal analysis, writing original draft preparation, writing review, and editing. All authors have read and agreed to the published version of the manuscript.

Conflict of Interest

All authors have no conflict of interest related to this study.

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