Planning, Designing and Developing of Digital Libraries and Digital Preservation

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Abstract

Digital libraries represent the meeting point of many disciplines and fields, including data management, information systems, information retrieval, library sciences, document management, the web, image processing, artificial intelligence and human-computer interaction. Due to these technological invasions majority of libraries are getting converted into digital libraries which provide suitable help to fulfill their users' basic objectives of providing relevant information. This is so because globalization of information is taking place and territorial boundaries are becoming meaningless due to developments in information and communication technology (ICT) and traditional constraints of time and space are disappearing. Digital library is the electronic library in which the access, storage and dissemination of information is in the digitalized form. It is an attempt to touch base with all the areas relating to use of digital library and digital preservation in libraries in simple language. This paper briefly describes the planning, designing, development, guidelines for designing, characteristics, achieves, services, resources, maintenance, responsibility, role of librarian, strategies, definition, need, purpose, function, digitization in libraries, Standards, policy, Softwares available, LSDI, advantages, disadvantages, etc.

Keywords: Digital Library, Hybrid Library, Digital Preservation, Digital Library Archives

1. Introduction

Presently, there has been a paradigm shift in the concept of library and Information centers. Earlier in the traditional form of library and information services, we were concerned with documents in print format and their organization, retrieval and preservation. With the paradigm shift, now we are more or less concerned with hybrid libraries, digital libraries and virtual libraries. This is due to introduction of ICT which has brought about changes in the process of collection development, their organization and accessibility. Formerly, there were no competitors for libraries. At present with the emergence of web and internet, users can access their required information globally at any point of time and space in their work place. Therefore, the very existence of libraries is in question. In order to establish the importance of libraries, we have to change our traditional methods of services to modern service methods. In this changing environment, to compete with the advanced needs of users, establishment of digital library is an essential component. Today's world is digital world, which is concerned with creation, sharing and using information in digital form. Information is floating in all directions and moving all around us. We have to catch right information and make it available to right person at the right time, which is the aim of any modern library. Digital Library is a collection of digital objects (text, video, audio) along with methods for access and retrieval and also for selection, organization and mainte-

nance. Digital preservation is the method of keeping digital materials alive so that they remain usable as technological advances render original hardware and software specifications obsolete. Digital preservation is a process by which digital data is preserved in digital form in order to ensure the usability, durability and intellectual integrity of the information contained therein.

2. Digital Library

A digital library is a library in which collections are stored in digital formats (as opposed to print, microform, or other media) and accessible by computers. The content may be stored locally, or accessed remotely. The first published use of the term has been traced to a 1988 report to the Corporation for National Research Initiatives. The term was first popularized by the NSF/DARPA/NASA Digital Libraries Initiative in 1994. Bush (1945) created a vision based on experience ("Digital library.")

The Digital Library Federation defines digital libraries as:

Organizations that provide the resources, including the specialized staff, to select, structure, offer intellectual access to, interpret, distribute, preserve the integrity of, and ensure the persistence over time of collections of digital works so that they are readily available for use by a defined community or set of communities. (Shiri 2003)

Lynch (1994) states that, "digital libraries provide users with coherent success to a very large, organized repository of information and knowledge." According to Berkeley Digital Library Project, University of California, the digital library will be a collection of distributed information sources. The contrast between traditional and digital libraries is presented below:

Traditional Libraries	Digital or Electronic Library
Print collection	All resources in digital form.
Stable, with slow evolution	Dynamic and ephemeral
Individual objects not directly linked with each	Multi-media and fractal objects other
Flat structure with minimal contextual Metadata	Scaffolding of data structures and richer contextual metadata
Scholarly content with validation process	More than scholarly content with various validation processes
Limited access points and centralized management	Unlimited access points, distributed collections and access control
The physical and logical organization correlated	The physical and logical organization may be virtual
One way interactions	Dynamic real time dialogue
Free and universal access	Free as well as fee based

2.1 Traditional libraries are shifting towards Hybrid Library

With the development of new technologies, the traditional closed access libraries are shifting towards the open access libraries and the open access libraries are shifting towards automated libraries, the automated one towards the electronics, the electronics to digital and finally end in digital library. Nobody knows what will be the future of libraries. On the basis of technology used, the libraries can be categorized as:

a. Traditional Library: The collection of the traditional libraries is mostly print media, manuscripts, etc. and are not well organized. The documents are deteriorating at a rapid pace, the collection information is not easy to locate and so does not easily reach users, again the traditional libraries are confined within a physical boundary.

b. Automated Library: A library with machine-readable catalogue, computerized acquisition, cir-

culation and OPAC are called as automated library. The holding of this type of libraries are same as the traditional libraries.

c. Electronics Library: When automated library goes for LAN (Local Area Networking), CD-ROM networking, starts procuring e-journals and other similar kind of publications then it is known as electronic library. The resources of the electronic libraries are in both print and electronic form. The electronic media are used for storage, retrieval and delivery of information.

d. Digital Library: It is a later stage of electronic library. In digital library, high speed optical fibers are used for LAN and access is over WAN and provide a wide range of Internet based services, i.e., audio and video conferencing and like others. Majority of holding of a digital library are in the computer readable form and also act as a point of access to other online sources.

e. Hybrid Library: The libraries, which are working both in electronic or digital and print environment, are known as hybrid library. Actually it is a transitional state between print and digital environment.

3. Characteristics of Digital Libraries

The different characteristics of digital library are as follows:

❖ **Collection**: A digital collection of electronic documents or other resources presented as a purposeful assemblage, e.g., organized and presented according to library or archival principles or representing the digital holdings of an institution.

❖ **Work**: Digital libraries are to be used by individuals working alone. There is work oriented perspective focusing on a group of information analysts, work being done and the documents and technologies that support it.

❖ **Technology:** Technologies which are used for digitization are as follows:

♦ Computer Technologies

♦ Processing Technology

♦ Communication Technologies

♦ Display Technologies

❖ **Trans-bordering of Information:** Breaking the physical boundaries of data transfer within and outside the countries. It is viewed that the support for communication and collaboration is as important as information seeking activities.

4. Functions of Digital Library

Functions of digital libraries are:

❖ Access to large amounts of information to users wherever they are and whenever they need it.

❖ Access to primary information sources.

❖ Support multimedia content along with text.

❖ Network accessibility on Intranet and Internet.

❖ User-friendly interface, hypertext links for navigation.

❖ Client-server architecture.

❖ Advanced search and retrieval.

❖ Integration with other digital libraries.

5. Purpose Of Digital Library

Purpose of a digital library is:

❖ Expedite the systematic development of procedures to collect, store, and organize, information in digital form.

❖ Promote efficient delivery of information economically to all users.

❖ Encourage co-operative efforts in research resource, computing, and communication networks.

❖ Strengthen communication and collaboration between and among educational institutions.

❖ Take leadership role in the generation and dissemination of knowledge.

6. Components of Digital Library

The components of a digital library are:

❖ Infrastructure, Digital Collection, Systems function

❖ Telecommunication facility, Human resources

❖ Hardware Requirements are:

❖ Computer servers, Networks, LAN/WAN, Converters, Scanners

❖ Internet Connectivity, Storage media, Multimedia Interface, UPS

❖ Software Requirements are:

❖ Liner Operating Systems, Digital Library Software, Greenstone, Fedora

❖ D-space, Editing Software, E-print

6.1 Basic Needs for Digital Library

❖ For the development and operation of digital library, the technological environment is pro-

vided by the Internet and World Wide Web. The web provides tools and techniques for publishing the information over internet while the internet provides the TCP/IP and or its associated protocol for accessing the information. Some of the basic requirements for a digital library are:

❖ **Computer**: Server, PC, with multimedia, UPS, etc.

❖ **Software**: Any suitable software, which is interconnected and suitable for LAN and WAN connection

❖ **Network**: LAN, MAN, WAN, internet, etc.

❖ **Storage devices**: Optical storage device, CD-ROM, Jukebox, etc.

❖ **Scanner**: H.P. Scan Jet, Flatbed, sheet feeder, Drum Scanner, Slide Scanner, Microfilm Scanner, digital camera, Barcode Scanner, etc.

❖ **Printer**: Laser Printer, Dot Matrix Printer. Digital Graphic Printer, etc.

❖ **Audio Visual**: Color TV, V.C.R, Sound box, Telephone, etc.

6.2 Resources

All the materials, either print or electronic/digital material which can be stored, organized, transmitted and displayed by the computer without any intervening conversion process, are the resources of a digital library. For a digital library there are two types of resources:

6.2.1 Online Resources

❖ E-books, v-books, electronic text, map, image, sound, video, and multimedia, etc.

❖ E-journals

❖ Local database of traditional books in machine-readable form

❖ LAN, MAN, WAN for web browsing, e-mail, etc.

❖ Well trained man power for online help

6.2.2 Offline Resources

❖ CD-ROM

❖ Audio Visual aids, etc.

7. Digital Libraries Services

Some of the services of digital libraries are:

❖ Catalogue databases, making scholarly journals accessible on the web

❖ Hosting digital collection and indexes, Current Awareness Bulletins

❖ CD-ROM Databases, Remote Information Services, Search engine services

❖ Internally published newsletters, Reports and Journals, Internet information

❖ Electronic Document Delivery Services, Reference Service

❖ Electronic Publishing, Web-based reference and information services

❖ Special Collection Services, e-mail, ETD, Electronic Table of Contents

8. Planning For Digital Library

Digital libraries serve communities of people and are created and maintained by and for people. People and their information needs are central to all libraries, digital or otherwise. All efforts to design, implement, and evaluate digital libraries must be rooted in the information needs, characteristics, and contexts of the people who will or may us those libraries.

For the development of digital library, firstly we should plan for our task or objectives of any type of library and what issues are addressed prior for the development of digital library. It is not a detailed of step by step guide, it is used to provide guidance what is wrong and what is right to his/her library, which resources are more valuable for library. Planning is used to provide backbone for any digital library.

8.1 Planning Aspects

There are some points to be kept in mind when plan for creating digital library:

Information Needs: There are three main components of any library, resources, librarian and the most important one is its user. If there are no users there is no need for establishing library. For planning for digital library, we have to keep in our mind which type of users have access it to it and if access are not restricted, what are the next steps for library to fulfill the need of its users.

Quality in plan: We plan for what type of software is beneficial for our digital library. Are users are satisfied with it? What are benefits of using this? Is it easy to learn? How searching facility is provided to users in an easy way? Those entire questions have to be answered before we prepare plans for creating digital library.

Security issues: Security issues for the development of any digital library are must. There are some pre-planned rules of using digital library which are to be clarified concern how users access their desired information. Backup plan, if in case of any mishappening is also required. How to

control security threat protection (firewall, antivirus, etc.), has to be determined.

IT Infrastructure: Digital library requires well tested and proven information technologies including the multimedia kit, data handling, memory, processing and storage, computer software such as OCR and library application software, etc.

Digitization: For digitalization of library resources such as book, serials, thesis, dissertation reports, current and back volumes of periodicals, institutional publications, seminar proceedings in digital form equipments like scanners, printers, digital camera have to be procured.

Access: Users are required to be given user ID and password to access the materials in digital form. There should not be limitations for access of digital materials for authorized users.

Staffing: The staffs have to be trained in handling digital work.

Funding and Budget: To meet the expenditure for the digital library, appropriate funds should be provided by the library authorities. Plan for budget, other aspects related to digital library like, human resources, software, hardware application, etc. Upgrading new technologies, etc. are another important aspect for planning a digital library.

Digital Library Committee: A digital library committee should be formed to plan for its creation and maintenance. The members must be from various library departments and, if necessary, consultants can be hired. There are at least two ways of developing a digital library, firstly by converting a traditional library into a digital library, and secondly, by direct development of a digital library.

Creation of Digital Library: After preparing plan it is time to create the digital library.

8.2 Guidelines for Digital Library Design

The following aspects can be considered as guidelines for the development of the digital library architecture.

Service driven: The architecture for the digital library must be driven by the services it provides and tools required for delivering the service.

Open Architecture: The architecture of the digital library must be open, extensible and support interoperability among heterogeneous, distributed systems.

Scalability: The digital library architecture must be robust, scalable and reliable with high transaction rate for users with a wide variety of backgrounds and information needs.

Practicality: The digital library architecture should represent a flexible and practical approach to standards, recognizing the need to balance the level of information collection with economic constraints.

Privacy: The digital library architecture must be sensitive to privacy issues and support both anonymous and customized access to resources.

Time Frame: The time frame required to plan for system migration in the next year as well as planning for a technology generation framework should be approximately 3 to 5 years.

9. Building Digital Collections

The traditional library's major collection is print medium and now the libraries are being converted into hybrid libraries, wherein the collection also

consists of both print and digital collections. As discussed earlier, looking at the advantages of digitization, the libraries are building their digital collection. Various methods adopted for building digital collections are:

❖ Directly creating the digital documents.

❖ Downloading the digital information from internet.

❖ By digitizing the existing collections.

❖ Procurement of digital materials such as e-journals, e-books, e-reports, etc.

❖ Getting the digital materials information online.

10. Digital Libraries In India

Given below are some digital libraries of India:

❖ Digital Library of India, IIS, Bangalore

❖ Nagri Pancharini Sabha, Varanasi.

❖ Kumaun University, Nainital.

❖ G. B. Pant University of Agriculture & Technology, Pant Nagar.

❖ The Million Book Project.

❖ Digital Library of India Institute of Management, Kozhikode.

❖ Digital Library of Library & Information Science.

❖ ETD at Indian Institute of Science.

❖ Indira Gandhi National Centre for the Arts Digital Library

❖ Nalanda Digital Library

❖ Vidyanidhi : Digital Library

10.1 Other Digital Libraries

Some other digital library initiatives under mega center project in co-operation with Lis. Sc, CMU and MCIT for the Government of India and 21 participating centers are:

❖ Lal Bahadur Shastri National Academy of Administration.

❖ Delhi Engineering College, Library.

❖ Delhi University, Library.

❖ Birla Institute of Technology and Science, Pilani.

❖ Association of Indian Universities.

❖ Gurukul Kangari, Haridwar.

❖ National council of Educational Research and Training (NCERT).

❖ Dyal Singh Library.

❖ Indian Council for Cultural Relations (ICCR).

❖ Indian Agricultural Research Institute (IARI)

❖ The Energy and Resources Institute (TERI).

11. Maintenance Of Digital Libraries

Once digital library is created, for its long term benefits, maintenance is must. This is to ensure that library system is working in good condition and for conducting routine review of library holdings. It is also to be ensured that files are downloaded properly. New content have to be identified. Tools which are chosen for accessing information should work properly. Converted file format to required format have to be secured. Financial resources for review of materials in library have also to be secured. For this, feedback from library user is to be obtained. Antivirus has been properly worked or not. (Figure 1)
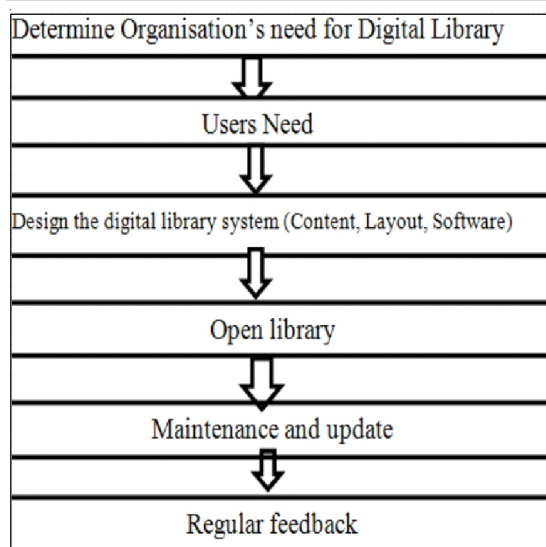
Figure 1: Maintenance Process of Digital Libraries

Figure 2: Digital Library Achieve

12. Digital Library: A Global Connection

Digital libraries are emerging in many parts of the world to give access to the world's scientific developments. Searching across these multidisciplinary repositories is a daunting task. Some of the research in the digital libraries initiatives is beginning to indicate that this can be done. A global interconnected library network of existing collections has begun to emerge. Its Web site (www.ifla.org) is maintained by the International Federation of Library Association and Institutes (IFLA). IFLA launched an electronic network strategy in 1994 as an experiment to connect its members to its conference in Havana, Cuba. At the beginning of 1998, libraries in more than 70 countries were connected to this global library network, sharing information and expertise. The Figure 2 shows the digital archive in the library.
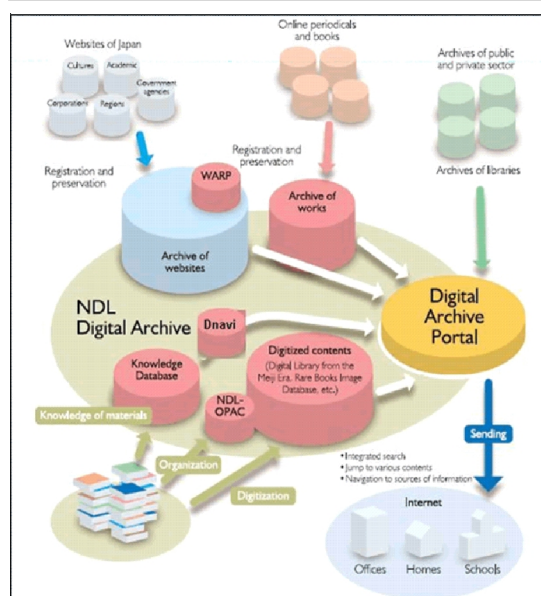
13. Preservation of Digital Contents in a Digital Library System

Preservation and archiving of digital contents is one of the most serious concerns of libraries, whether acquired through subscription, purchased in digital media or converted in-house. Moreover, the academic community looks upon libraries to preserve materials that were ever accessible to them on internet at least in an offline digital format, such as stored on-line (or on CD-ROM, diskettes or other physical carriers) or to the products of analog to digital conversional long-terms access in intended.

There is a wide range of digital formats available and to make smaller more complicated, different digital object have different preservation requirements. These can depend on the reason the record is being preserved, how long it needs to be preserved, the context and history of the record, and its original format. Digital preservation does not mean the same thing for each digital object. In all cases the record

must be preserved so that it retains its integrity and is authentic and usable.

- ❖ Monitor the preservation implications and priorities for preservation implications and priorities for preservation of different information resources,

- ❖ Store and manage these resources to ensure high security, automated checking, archiving and back up with adequate disaster preparedness and recovery procedures,

- ❖ Document collections including file formats, software and hardware dependencies,

- ❖ Classify these resources based on their content and functionality,

- ❖ Record preservation of metadata that facilitates effective and efficient management, and

- ❖ Develop appropriate pathways to access these resources in conformity with its authenticity, intellectual property rights (copying, storage, modifications and use of specific resources) and cost effective as well.

13.1 Digital Preservation

Digital preservation is the methods of keeping digital materials alive so that they remain usable as technological advances render original hardware and software specifications obsolete. Digital preservation is a process by which digital data is preserved in digital form in order to ensure the usability, durability and intellectual integrity of the information contained therein.

13.2 Standards for digital preservation

For preservation of digital documents or information overtime, the following types of standards are required.

- ❖ Standards for architecture

- ❖ Standards for preservation access

- ❖ Standards for interoperability

- ❖ Standards for preservations content

- ❖ Standard for document Format

13.3 Digital Preservation Policy

At the present time, the policy for ensuring long-term storage, maintenance, migration and access to digital materials, weather at the local or national level, are not frequently present both in the private and in the public sector. Moreover, the policies publicly available via web are mainly developed by cultural heritage institutions and have been elaborated very recently. The primary aims of a policy are to provide guidance and authorization on the preservation of digital materials and to ensure the authenticity, reliability and long-term accessibility of them. Moreover, a policy should explain how digital preservation can serve major needs of an institution and state some principles and rules on specific aspects which then laid the basis of implementation.

13.4 Softwares Available for Digital Preservation

Softwares that does digital preservation for asset management come in two forms:

- ❖ There are softwares that help to manage items through the entire digitization process and create a "place" for users to locate (e.g. CONTENT dm).

- ❖ Secondly, there are softwares that only provide indexing and access services, but do not provide a wide verity of file formats including digital image (e.g., in magic content server). The software packages listed below fit into one of these categories:

♦ Alchemy(R) Information Management re search Inc. http://www.imrgold.com

♦ CONTENT dm , DiMeMA, Inc.http:// contentdm.com/

♦ Improved access-searching and browsing. Search becomes easy and comfortable.

13.5 Digital Preservation Strategies

Many digital preservation strategies have been proposed, but no single strategy is appropriate for all data types' situation or institution. Digital preservation strategies are mentioned below:

❖ Bit stream copying, refreshing, durable persistent media, technology preservation.

❖ Digital archaeology, analogue backups, migration, reliance on standards.

❖ Normalization, emulation, encapsulation, compression.

❖ Metadata attachment and trustworthy digital objects.

❖ Large –Scale Digital Preservation Initiatives.

13.6 Responsibilities of Librarians

Some of the responsibilities of librarian are as follows:

❖ Managing digitization projects and staff

❖ Fundraising and grant writing , managing budgets

❖ Writing job descriptions, hiring staff

❖ Setting goals and targets

❖ Writing documentation and reports

❖ Cataloging and indexing digital objects

❖ Monitoring of digitization procedures and performing of quality assessment

❖ Developing delivery mechanisms and finding aids

❖ Preservation and archiving of digital objects

❖ Instruction and end-user support

14. Role Of Librarian in Digital Environment

The new environment is really challenging one for the librarians to decide who are publishers and who are users? In the new environment it is to very difficult to decide what should be organized? How to give citation? How to organize the collection? In the new environment, any one can be a publisher by merely posting messages to online discussion group or by other means, which has access to the network of digital libraries. In some cases, librarians have the opportunity to digitize unique material in their libraries' collections. Thus the librarian is more or less a hypertext engineer, because they are needed for packaging and repackaging of information, for electronic publishing, for reference purpose, to advise the user about the strategy to identify relevant electronic sources etc.

The new environment requires a new technical set of competencies for librarians which were not previously required. Skills such as creating web pages, building and maintaining computer networks, designing search interfaces, etc. are sought after in today's library employment market. Along with the need for technical skills is the ability to cultivate a level of comfort with ambiguity and change. Librarians must accommodate with the one characteristics of the digital library that is rapidly changing

and evolving nature of the environment. This environment is subject to immense change very quickly, and a key role for the librarian in the future will be the ability to adapt and to work effectively in such an environment.

15. Advantages of A Digital Library

The advantages of digital libraries include:

- ❖ Nearly unlimited storage space at a much lower cost
- ❖ Re-allocate funds from some staff, collection maintenance, and additional books
- ❖ No physical boundary, structural approach
- ❖ Round the clock availability
- ❖ Multiple access, networking
- ❖ Enhanced information retrieval
- ❖ Preservation for print material
- ❖ Added value, information retrieval
- ❖ Universal accessibility

16. Limitations of A Digital Library

Besides the several advantages listed above, there are also some limitations of digital libraries as below:

- ❖ Lack of screening or validation
- ❖ Lack of preservation of a fixed copy (for the record and for duplicating scientific research)
- ❖ Lack of preservation of "best in class"
- ❖ Difficulty in knowing and locating everything that is available, and differentiating valuable from useless information

- ❖ Job loss for traditional publishers and librarians
- ❖ Costs are spread and many become hidden.
- ❖ Copyright, initial high cost, band width, speed of access and preservation

17. Conclusion

There will be continuing expansion of digital library activities. LIS and computer science professionals face challenges that will lead to improved systems. More and more libraries will have departments and programs in the digital library arena. Digital libraries will build upon work being done in the information and data management area. Digital libraries provide an effective means to distribute learning resources to students and other users. Planning a digital library requires thoughtful analysis of the organization and its users, and an acknowledgement of the cost and the need for infrastructure and ongoing maintenance (Adams, Jansen, and Smith 1999). Digital libraries present opportunities and challenges for the library and information communities and all stakeholders. It also is going to be part of day to day professional activity in the next couple of years. In simple words, it is quite impossible for libraries and information centers to meet the various information needs of the present day society without library networking. One hope in the near future that all the libraries in world will be without walls, and resources of all libraries will be available to the whole user community through networked digital libraries.

The relevancy of the Ranganthan's Five Law of Library Science is still prevalent in this new digital era also as information scientists have reinterpreted it in the following manner:

- ❖ Digital resources are for use.
- ❖ Every user his/her digital resources.
- ❖ Each digital resource for its user.

❖ Save the time of the digital resource user.

❖ Digital library is an overgrowing organism.

As such to realize their mission and goal, professionals working in the digital library environment need to develop skills to render services in the most efficient and effective manner to meet the needs of the users. The digital preservation is process that requires the best available technology, careful thought, administrative policy and procedures. Preservation in the area of digital technology is charged responsibility. Therefore, the information professionals are to be trained in area of digital preservation and digitization techniques.

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