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Aspects of Digital Libraries

Digitization, Standards, Open Access, Repositories and User's Skills

Edited by Liat Klain Gabbay

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Meet the editor

Liat Klain-Gabbay completed her doctoral studies at Bar Ilan University, Israel, in the Department of Information Science, with a research focus on academic libraries, open access, and scholarly communication, utilizing a mixed methods approach. She also holds an MA in East Asian studies from the Hebrew University, Jerusalem, where her research delved into the educational system of the North Korean minority in Japan. Furthermore, she successfully completed a certificate program in Japanese language and culture at Soka University, Japan. Liat's educational background includes a BA in East Asian studies and special education from Tel Aviv University, along with a certificate in library and information science from Beit Berl College, Israel. With 16 years of experience as a librarian and information specialist at the Library of the College of Management, Israel, Liat has developed strong expertise in areas such as databases, information technology, and acquisitions, while also providing valuable reference services to both students and faculty members.

Contents

Preface

Understanding the web environment is pivotal for constructing a digital library, as it serves as the foundation for the technologies operating within it. Acting as a computing platform, the web environment fosters the growth of web technologies through established standards and protocols. It operates on a client/server architecture, where the client (web browser) requests data from the server (web server). This architecture empowers web users with access to powerful computers on the server side while enabling instantaneous response to user input on the client side.

In the realm of academia and research, timely access to information is paramount, marking a shift toward a knowledge-centric era. Digital tools play a crucial role in assisting scholars and researchers, particularly in managing academic theses and dissertations. Concepts such as digitization and metadata are vital for preserving and efficiently accessing digital collections and digital repositories.

Moreover, this book addresses the evolving role of information professionals and the challenges faced by libraries in the digital age. It highlights the benefits of digitization in academic libraries, including enhanced accessibility and resource preservation. The importance of modernizing library services to meet contemporary demands is emphasized, alongside challenges like information overload and accessibility.

Digital libraries emerge as a solution to traditional constraints, facilitating unrestricted access to information. They serve various purposes, including preserving cultural heritage and supporting teaching and research. Standards and guidelines are crucial for ensuring the quality and sustainability of digital libraries.

In the context of organizational influence, digital culture shapes libraries and information centers, like business organizations. It seems there is an interplay between digital culture, open access to academic publishing, and institutional repositories, shedding light on their transformational impact.

I would like to express my deepest gratitude to the authors who wrote and contributed the chapters for this book which are so relevant in the information age. I would also like to thank IntechOpen for the opportunity to edit this interesting and important book.

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Section 1

Digitalization – Technological Issues

Chapter 1

Digital Convergence and Memory Information Systems in Developing the Performance of Galleries, Libraries, Archives, and Museums (GLAM)

Mukhlis and Nurdin Laugu

Abstract

This paper discusses university efforts in developing digital convergence and information systems to manage, compile, and disseminate institutional memory documentation in a digital format known as the acronym SIMEMORI (memory information system). The plan was developed within the framework of digital convergence toward galleries, libraries, archives, and museums (GLAM), which has become a world trend today. The GLAM knowledge collection needs to be managed systematically and standardized so that the academic community and users can realize superior organizational sustainability based on technology and culture. Working on the organization's collective memory is one of the foundations for developing university information organizations to maintain this memory through institutional digital convergence. The outcome of this digital convergence will increase educational activities and historical preservation, improve research performance, and guarantee the GLAM culture of quality and service innovation.

Keywords: digital convergence, institutional development, memory information systems, GLAM performance, Brawijaya University

1. Introduction

The highly growing development of digital technology has led society to an increasingly complex adaptation process. The complexity of adapting to the development is not only related to getting used to and accepting each of the latest digital devices but also requires strengthening individual competence and convergence among institutions. Strengthening the competency relates to digital literacy competencies [1, 2]. Digital literacy is a competency or ability to select and use digital devices, create digital content, present digital presentations, and be responsible for socializing various digital messages in society, primarily through library services [3–5]. Meanwhile, digital convergence through integration and collaboration between

institutions includes managing, compiling, and disseminating institutional collections in digital and online forms [6].

Digital convergence is a development and the latest trend in today's technology field. According to Vårheim [7], this development was popularized since the 1990s, which was marked by the widespread practice of digitalization by memory institutions, including libraries, archives, museums, and galleries. Digital convergence brings enormous change everywhere and continuously [8]. This condition is reinforced by Robinson's statement [9] that digital convergence has been a means of communication and interaction between institutions since the beginning and fosters cross-professional collaboration, such as librarians, archivists, and curators. Digital convergence carried out by memory institutions has now become an international trend and will continue to experience development. In this way, a collection of memory institutions is a source of knowledge, so systemic management and convergence are a must.

As one of the international trends, digital convergence has also penetrated the realm of higher education, especially the library, as an information management unit. University libraries in Indonesia, for example, have nuances of convergence between memory institutions, such as libraries and museums. The Libraries of the Indonesian Islamic University in Yogyakarta place the library building adjacent to the museum building. The Eleven March University Museum in Surakarta City, Central Java, is also attached to the library. In a broader scope, the Faculty of Administrative Sciences, Universitas Brawijaya, located in Malang City, East Java, has even developed a memory information system called SIMEMORI, which functions to manage, compile, and disseminate digital format institutional memory documentation that can be accessed online. The system carries the concept of convergence of collections of GLAM memory institutions (libraries, archives, museums, and galleries).

Digital convergence as an institutional development effort through strengthening the integrative management of institutional memory collections has yet to be widely implemented as far as the author's observation and tracing from the four institutions above. The practice of digital convergence, which represents governance and dissemination of a systemic and convergent collection of memory institutions, has been carried out by the Faculty of Administrative Sciences, Universitas Brawijaya, through its memory information system (SIMEMORI). The system has combined the management and service between collections of libraries, museums, and archives owned in one system. The development of interinstitutional digital convergence practices is in line with Cannon's statement [10] in his study, which revealed that through digital convergence, users expect a service output in the form of one access door, namely an integrative institutional interface between galleries, libraries, archives, and museum collections.

In reflecting on this reality, digital convergence practices carried out in one system are interesting to study. Moreover, a system capable of representing collections from memory institutions from GLAM (galleries, libraries, archives, and museums), such as SIMEMORI. Therefore, the reason that prompted the author to choose SIMEMORI, developed by the Faculty of Administrative Sciences, Universitas Brawijaya, is that this system can respond to user needs, as stated by Cannon above. Another reason is that this system won first place in the 2022 Universitas Brawijaya Public Service Award (UBPSA). This advantage cannot be separated from various essential factors. In the author's findings, SIMEMORI has a role model in governance, which includes acquisition, management, and services which are interesting to study—also, the participative aspect of the contributors, which is also interesting in this regard.

Increasing ease of access to knowledge for users of memory institutions is often cited as the reason for the need for convergence.

2. Theoretical framework

2.1 Digital convergence

Digital convergence combines digital technology components and features in voice, text, video, images, broadcasts, presentations, streaming media, global connectivity, and personalized services. The unification combines various electronic systems' features and capabilities into a simplified, converged, and computer-mediated communication system to enable individuals to interact, communicate, collaborate, and share information in new and different ways [11]. In addition, according to Strader [12], digital convergence is the result of efforts to link various previously unrelated technologies to become more closely integrated and even unite as these technologies develop. Thus, according to Vince [8], digital convergence revolutionizes how data is collected, stored, annotated, presented, and accessed. Besides having other benefits, such as cost efficiency, quality improvement, and access flexibility, digital convergence results can be stored in a flexible, accurate, and durable format that previous technologies could not.

2.2 Information system

An information system is a set of integrated software that works together with information technology to support individual, group, organizational, or societal goals. It is designed to collect, process, store, and distribute information [13]. Meanwhile, according to Alter [14], the information system is a set of integrated software that works together with information technology that is directed to support the goals of individuals, groups, organizations, or society. An information system can be understood as a system designed to collect, process, store, and distribute information to support the functions and objectives of the institution.

2.3 Digital information assets

Digital assets are valuable electronic information content stored digitally in various formats [15]. In addition, these assets are intended as meaningful collections of information and managed as a single entity so that they can be understood, shared, protected, and exploited effectively [16]. Meanwhile, according to Kamat [17], digital information assets are information assets that are digital in format, defined, stored in any way, not easy to replace without cost, expertise, time, resources, and their combinations, and are recognized as something of value to the organization. Therefore, digital information assets owned and managed by information institutions have a particular value, so they must be protected and used effectively and carefully.

2.4 Convergence of GLAM (galleries, libraries, archives, and museums)

Scholars have defined GLAM institutions as memory institutions and knowledge organizations [6, 18]. According to Davis and Howard [19], the core characteristics of GLAM institutions are digitization, collaboration, and convergence of many

issues and dynamics. Galleries, libraries, archives, and museums (GLAM) is not just a memory institution that collects and organizes knowledge objects. It also innovates with new things and improves means to enhance dissemination of the knowledge it collects [20]. In this regard, GLAM is an example of the oldest memory institution of a knowledge organization. It includes core processes, such as collecting, organizing, preserving, and providing access to knowledge objects, from which the process becomes a reference for other organizations that are managing their collections. Knowledge-based [21]. Furthermore, Hedstrom revealed that the GLAM institution collects and organizes books, documents, and objects and specializes based on country, language, scientific discipline, audience, classification system, and taxonomy to differentiate publications from manuscripts and separate documents with three-dimensional objects. According to Marcum [21], the advantages of GLAM convergence consist of cost savings, collection expansion, simplified access, wider user reach, and attractiveness (branding).

3. Method

This research uses a descriptive method with a qualitative approach. Research with a descriptive method is a study that seeks to explain research narratively, as it is so that the object of research is adequately exposed [22]. Meanwhile, qualitative research provides explanations and arguments in an interpretive and constructive manner to the data presented in a descriptive narrative manner. Interpretation of data through a constructivist paradigm will present arguments and critical analysis so that the research results are comprehensive and heuristic. In addition, the meaning that can be obtained can go beyond descriptive narratives so that new findings can be written in research conclusions [23].

The data collection technique used is interviews supported by observation. Interviews were conducted with three staff members of the Center of Information System and Public Relations assigned to manage SIMEMORI and two students as users. The number of informants is deliberately limited based on information needed for the paper. At the same time, the observation was carried out to make direct observations in the field and make observations through the SIMEMORI application. The informants can be seen in **Table 1**.

No.	Informant	Position
1	Info.MS-01	Staff SIMEMORI
2	Info.OM-02	Staff SIMEMORI
3	Info.MR-03	Staff SIMEMORI
4	Info.AM-04	Student (user)
5	Info.BG-05	Student (user)

Source: Researchers' data processing.

Table 1.
Demography of informants.

No.	Main aspect	Outcome
1.	Acquisition	Knowing the acquisition criteria, types of contributors, and formats
2.	Management	Knowing the process of management, media convergence, inventory, data entry/uploading, and maintenance
3.	Dissemination	Knowing the content dissemination process through the SIMEMORI application portal and related facilities

Source: Researchers' data processing.

Table 2.
Aspects of digital convergence in the SIMEMORI system.

The results of the interview as the primary research data are confirmed for validity through triangulation techniques in the form of source triangulation and technical triangulation. Source triangulation was carried out by comparing interviews with a number of informants to ensure data validity was achieved [22]. The subsequent validity is a triangulation of techniques through discussions of data obtained from interviews and observations to ensure the relevance of the two data. The relevant data will be cited as valid data and used as a source to explain the study's object. During the research, there was no conflicting data found in the results of interviews with informants; it just had its breadth, which showed variations in situations that occurred among informants.

The conceptual construction being analyzed includes three main things related to digital convergence carried out by SIMEMORI managers through acquisition, management, and dissemination activities. The three main things with each element analyzed can be seen in **Table 2**.

The last point in reviewing this method is the data analysis used on the results of the interviews obtained and field observations. The data analysis technique uses Miles & Huberman, consisting of three essential components: data reduction, data display, and data/research conclusions verification. The chart of data analysis techniques can be seen in **Figure 1**.

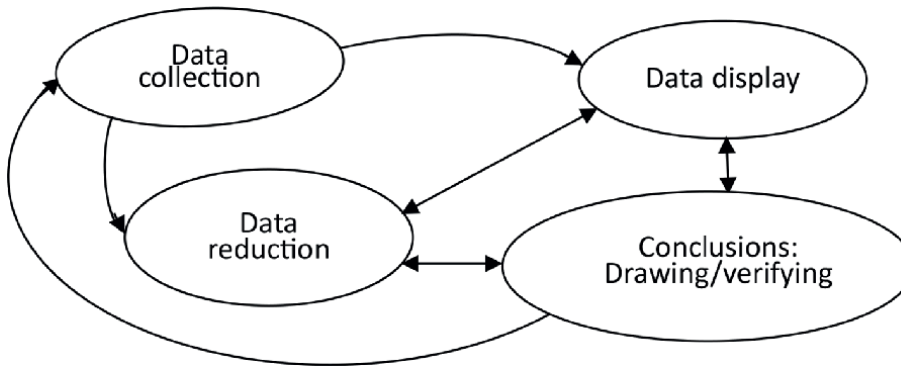

Figure 1.
Components of data analysis by Miles & Huberman. Source: Laugu [24].

4. Result and discussion

The results and discussion are seen in two important parts: a brief description of the place of research and findings accompanied by analysis. These two parts are presented in a narrative descriptive manner, especially in the first part. Meanwhile, the second part is presented descriptively to describe the empirical reality of the research object and analytically to explain the phenomenon more deeply and seek to find the implied meanings in collecting research results.

4.1 A glance at the SIMEMORI system

The Faculty of Administrative Sciences, Brawijaya University, Malang, Indonesia (from now on referred to as FIA UB) develops an information system that manages, compiles, and disseminates the use of digital format institutional memory known as the memory information system (SIMEMORI). The system carries the concept of convergence of the four memory institutions, such as libraries, archives, galleries, and museums, which has become a trend internationally, especially in higher education. This system has a vision as a university of administrative science memory that connects the academic community with history, arts and culture, and knowledge characterized by the Tri Dharma of higher education [25].

The system developed aims to enable academics and the public to understand organizational identity through institutional memory, vision and mission, past achievements, and documented past experiences. Through this system, academicians and related multi-stakeholders are expected to synergize in the future and sustain the organization through excellence, adaptation to technological changes, and organizational culture. The reason for the Faculty of Administrative Sciences, Universitas Brawijaya Malang, to develop the system is based on the vision and mission instruments of the university and faculty toward a world-class university (WCU), namely by having four critical units of higher education memory institutions, namely an archive center, library, gallery, and university museum, systemically managed. Another reason is that it aims to realize institutional memory management in convergent memory institutions as a means of education, history, research, preservation, and recreation with service fusion, either through product, service, or process innovation [25].

4.2 Findings dan analysis

The results of the study describe a number of findings which are summarized in 4 (four) terms, namely an overview of SIMEMORI, procurement, management, and dissemination/dissemination. Based on this, this study found several important phenomena that will be described in the following discussion.

4.2.1 SIMEMORI: initiation, realization, and appreciation

The presence of the memory information system (SIMEMORI), which is managed by the Center of Information System and Public Relations, Faculty of Administrative Sciences, and Universitas Brawijaya, is inseparable from a long process. As one of the oldest faculties in Universitas Brawijaya, the faculty, at the beginning of the initiation of this program, began to pay attention to the management of organizational collective memory in a systematic and standardized manner, mainly in document

fulfillment to increase accreditation from national to international. Another driving aspect is the effort to unify the types of collections from the GLAM memory institutions that they have systematically or can be combined to make it easier for academics and the general public to recognize the identity and legacy of the institution. Even though, in the beginning, they understood that the collections of memory institutions were different and challenging to assemble, upon further examination, they turned out to be related and had an almost inseparable relationship. In the development process, this effort received strong support from the leadership of the Faculty of Administrative Sciences. It was also inseparable from the Library Science Study Program, which is under the auspices of the faculty. In this regard, interviews with several informants can be seen, among others, as follows.

- *How did the SIMEMORI program get support from the institution?*

  "...the initial idea of this system is inseparable from the form of implementation of the concept of information governance (information governance initiatives) based on national and internal standards and regulations of UB...the effort was also made to support the initiation of good institutional governance, which is also a part of the memory resilience program initiated by the dean of FIA UB... (Info.MR-03)" and "... first we want every data or documents that we have can be well documented...also one day when it is needed without difficulty finding it such as the need for audits to accretion for example...that is where we then try to make it happen ...coincidentally at the dean level there is a memory retention program, so I think this is a good opportunity to realize institutional memory management ... (Info.MS-01)."

In line with the issues, the results of the following interviews have explained the synergy through the support of lecturers and students of the library science study program through learning and practicum activities carried out by students, especially the practice of documentation in digital format. From this, digital convergence practices full of research, preservation, and recreational values are increasingly peaking. Two of the many interview results related to this matter can be seen below.

- *How has the SIMEMORI program been implemented and developed into an expected system that supports GLAM?*

  "...in the beginning we had time to think about its future realization and it just so happened that we in this unit (Center of Information System and Public Relations) got a lot of input and collaboration with the Library Science Study Program so that with the theory and practice they have we can focus on system development this...a number of courses that students can use to deepen their technical skills, for example document management courses, information governance, archives and IT courses which provide recommendations regarding the applications used...finally, we can make this SIMEMORI system a reality and along with its development we have many parties contributed content...last year won an award in a public service innovation competition, the Universitas Brawijaya Public Service Award (UBPSA) 2022 which was held by the Bureaucratic Reform Team of Universitas Brawijaya...support and appreciation from various parties began to arrive and that was our spirit trigger to continue to improve it... (Info.MR-03)"... and "...through practicum courses, I can practice related to document management, both printed documents that are converted to digital as well as document management based on born-digital...I think this system

> *was built (SIMEMORI) as a tool that can accommodate everything such as product innovation and services that merge into one and also represents the GLAM collection…besides being a learning tool, this system can also be an interesting recreational tool…(Info.AM-04)."*

The four interviews above illustrate that digital convergence must be distinct from the concept of information governance. This inseparability becomes a close relationship, especially in several essential factors. Information governance is the glue that drives convergence value and reduces risk in every aspect of it, such as data management, security and privacy, data integration and data quality, and master data management [26]. From the interview excerpt above, it can be understood that in realizing digital convergence, support and collaboration are needed significantly to strengthen institutional services and innovation, especially in institutional memory (GLAM) (**Figure 2**).

4.2.2 Acquisition

After the SIMEMORI system has been built, the step taken by the manager is to start entering data from each existing collection. In addition to determining the acquisition process, SIMEMORI content or collections are viewed from the type of collection, namely: Books & Periodicals, Born Digital, Documents, Mixed Media, Moving Images, Objects, Sound Recordings, Other, Still Images, Albums, Diaries & Scrapbooks, Education & Research, Arts & Culture, Maps, Plants & Architecture. The various types of collections become a reference in the acquisition process. In the author's findings, the acquisition of SIMEMORI collections or content is divided into

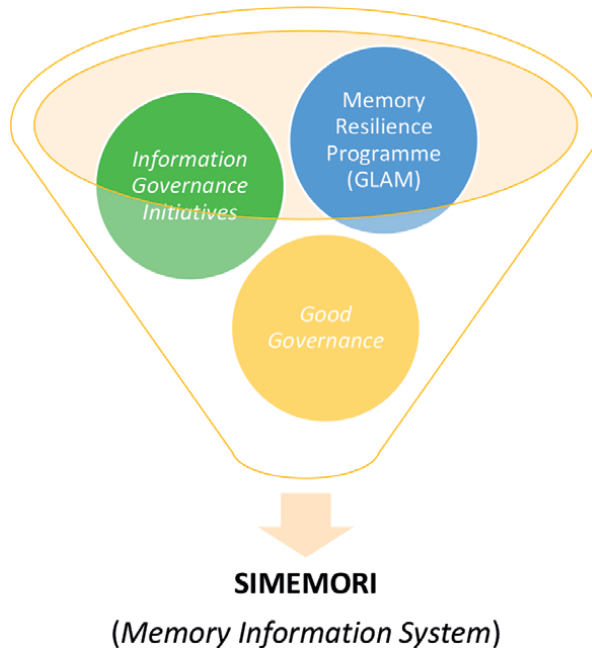

Figure 2.
Synergetic pillars of SIMEMORI. Source: Researchers' data processing.

two types: internal and external. An explanation of the two types of acquisition can be seen through the following interview results.

- *What are the collection criteria and types of SIMEMORI contributors?*

  "...acquisition of this collection we focus on categories or criteria such as having content or institutional memory values, past achievements and past experiences that have historical value...the point is that we receive all recorded information related to the institutions within it and then process it...most of it is still in the form of printed or paper-based such as written documents or old school photos so that we transfer them to digital form so that they are easy to enter into the system...the results of the documentation or documents that we obtain initially come from internal sources, such as from the academic community, staff, especially administrative staff who manage documents or archives and then submit them here to be managed...apart from internally there are also external parties, such as alumni who donate the results of documentation during college and or retirees who have institutional documents of historical value (Info.OM-02)" ...so far, if we look at the collection procurement process that was carried out, it was strengthened by contributors such as alumni, retirees (lecturers & staff), FIA UB academic community or from UB community members as a whole who have a kind of good participatory value...in the SIMEMORI application itself we have make a menu that donors can use to upload documents to be donated...in that menu there is also a form related to the identity of the contributor, for example alumni, academics, etc. There is also a form for the contact number of the contributor at any time you can use to request additional information related to the donated document. There is a column filled in regarding the description of the document donated; for example, an incident description or the fantastic term now is captioned so that everything can be done quickly and in detail... (Info.MS-01)."

Based on the interview excerpts above, it can be understood that the SIMEMORI content acquisition process is inseparable from a number of contributing parties, such as FIA UB's academic community, staff, alumni, retirees (lecturers & staff), and UB community members in general. In addition, each collection obtained must meet criteria such as load content or institutional memory value, especially historical and informative value, to support the learning and research process. To facilitate the procurement process, managers have embedded a menu that can be used for self-uploading on SIMEMORI, which donors can use to upload documents to be donated. The menu has been formulated according to the needs with no other purpose to facilitate the identification and management process. From this, the process of procuring the SIMEMORI collection is inseparable from a number of aspects, such as the existence of a shared awareness that fosters participatory value among contributors. In addition, the manager's creativity factor can accommodate contributors' efforts by providing a menu on the SIMEMORI system that makes it easy for them to contribute independently online.

4.2.3 Processing

The various collection formats that have been received are processed. In the author's observation, the initial stage of the processing is that the manager conducts an inventory to provide an identification number or Object ID for each collection. In addition, Object ID aims to determine the number of collections and identify the

acquisition. Example of an Object ID with the code "donatur_fia_01" explaining the source of the acquisition and collection serial number. After this stage is completed, the next step is to input bibliographic data which includes item name, collection type, donor name, collection condition, Object ID, collection genre, date/year of manufacture, and description/caption. After the data are filled in, the collection can be uploaded to the system. The capacity (file size) of documents in pdf, jpeg, jpg, png, tif, tiff, webp, and jfif formats is a maximum of 5 MB (Mega Bite). Meanwhile, files in multimedia formats such as MP3, MP4, and AVI are 20 MB (Mega Bite). This applies to document-type conversions (analog to digital). The process of transferring media documents carried out can be seen through the results of the following interviews.

- *How is the media transfer process carried out to support the availability of SIMEMORI content?*

> *"The process of document media convergence is carried out using scanning, photography or other digital conversions. The goal is that still physically based collections can be processed, uploaded, and served immediately... (Info.MS-02)."*

Another processing is carried out through routine checking of each collection that has been uploaded. this was done in the same way as the informant explained to ensure that all collections that have been uploaded can be accessed properly, can be read clearly, and minimize errors in providing information related to particular collections. Thus, the management process includes inventory, media convergence, and checking and repair. It is solely done to provide novelty in services. The most important thing is to maintain or maintain continuity of access.

4.2.4 Dissemination

According to the author's findings, the content dissemination process is generally carried out centrally through the SIMEMORI application portal. Even so, they also use social media as an alternative that is considered strategic to promote SIMEMORI to academicians, colleagues, and broadly to the public. Social media is an open secret whose existence is inseparable from people's social life. In addition, social media does not recognize the type and background of society. This media has penetrated all groups, from remote villages to urban centers, casual workers to professionals and executives, passive people to active people, and so on [27, 28]. Aside from being a means of disseminating or disseminating content, the management of SIMEMORI also hopes to increase the participation of academics and the public to contribute independently through the features (menus) that have been prepared. In addition to disseminating this information, involvement in the community in social adaptation efforts within the framework of new media technology is also in the form of educative, selective, and outreach. This form of participation can be described in the following interview results.

- *What are the efforts to disseminate the SIMEMORI collection to attract contributors' support?*

> *"...besides disseminating the SIMEMORI collection directly through the system, we also share URLs (Uniform Resource Locator) or SIMEMORI active links using social media, especially to students using WhatsApp to groups of lecturers or students,*

> *Instagram, Facebook and so on...because SIMEMORI is web-based, so usually we are assisted by the study program student association, so those who are actively posting... so far the results have been quite encouraging and those who have contributed more (Info.MR-03)"... and ..."regarding SIMEMORI I got the link which the lecturer shared with Class WhatsApp groups, and besides that, we can also get the same information through student association social media...it turns out that this system is very helpful and in my opinion this is interesting...so besides being able to donate documents, we can also enjoy various collections in the system (Info.BG- 05)."*

Based on the results of the interviews above, it can be concluded that the existence of social media platforms that move dynamically as a means of promotion and dissemination is expected to increase digital technology-based community participation such as self-uploading and active URL sharing of the memory institution collection management system that has been developed. All forms of involvement are social adaptation efforts to new conditions that must be accustomed to in their social practices. The influence of technology is very pervasive and even determines every action of society [29]. The participation of the academic community is also in the form of educational involvement and assistance. The presence of this participation has important qualifications, especially in facing the post-pandemic era through a participatory-technological tradition [30].

5. Conclusion

Digital convergence which represents efforts to manage collections of memory institutions, including libraries, archives, galleries, and museums, is one of the dynamic trends. Developments in digital convergence practices between memory institutions allow individuals to interact, communicate, collaborate, and share information in a variety of new, different ways. Digital convergence as an institutional development effort requires a service output as one access door for integrative institutional products. For this reason, efforts are needed through integration or collaboration between institutions, including managing, compiling, and disseminating digital format institutional collections online. At this point, the paper's conclusion can be seen in three aspects of SIMEMORI's governance that accumulate from the implications of digital convergence. These aspects are acquisition, management, and dissemination.

The SIMEMORI application, initiated by the Faculty of Administrative Sciences, University of Brawijaya, is inseparable from the initial stages or initiations. Awareness of the need to manage the organization's collective memory in a systematic and standardized manner and efforts to unify the types of collections from the four memory institutions in their GLAM in a systemic manner became the trigger for the birth of this system. This effort is inseparable from the concept of information governance (information governance initiatives), the initiation of good institutional governance, and the memory resilience program initiated by the dean of the faculty in 2022 ago. Acquisition of collections always prioritizes historical, educational, and research values for each item or document donated by donors. Several parties have contributed, including students, alumni, retirees (lecturers & staff), and UB community members.

Memory information system (SIMEMORI) content management is a process that is inseparable from digital convergence practices carried out by managers. Most of the donated document items go through a digitization process. An inventory stage follows

them to provide an identification number or Object ID for each collection. The goal is that collections can be processed, uploaded, and served immediately. Another stage is routine checking of each collection that has been uploaded as an integral part of the management process. The goal is to ensure that each collection that has been uploaded can be accessed properly, can be read clearly, and minimizes errors in providing information related to particular collections.

Likewise, the dissemination of collections is carried out centrally through the SIMEMORI application portal. It utilizes social media as an alternative which is considered a strategic promotional tool. Through these two ways, SIMEMORI managers hope to increase the participation of academics and the community to contribute independently as a form of educational involvement and assistance in institutional development.

Appendix

See **Tables A1** and **A2**.

No	Digital convergence [20]	Questions
1	Managing acquisition	1. What are the procurement criteria? 2. What types of documents (content) are processed? 3. Who contributed as contributors? 4. How to procure via the SIMEMORI application?
2	Compiling/processing	1. How is the document processing carried out? 2. What are the format and file size requirements of the document being processed? 3. What is the process of converting conventional document media to digital? 4. How are the monitoring and maintenance efforts carried out?
3	Disseminating	1. What is the document dissemination mechanism via SIMEMORI? 2. What is the dissemination process using social media? 3. What promotional tools are used? 4. How is the community's response to the existence of SIMEMORI?
4	A glance at the SIMEMORI system	1. What is the history or initial idea (initiation) of SIMEMORI? 2. How is the institutional support (leaders, academics, alumni)? 3. How was the preparation stage (system/application and content) carried out? 4. What is the description of the implementation of the initial stage?

Table A1.
Questionnaires.

No	Objects	Details
1	SIMEMORI	1. Staff/managers 2. Overview of SIMEMORI application 3. Types of contents 4. Promotion tools
2	Processed document formats	1. Printed collection 2. Digital collection 3. File size 4. Document types

No	Objects	Details
3	Media transfer tools	1. Types of tools used 2. Method/steps/process 3. Qualities/results (output formats) 4. Operator
4	Contributor & users	1. Students 2. Lecturers 3. Staff 4. Alumni

Table A2.
Observation.

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Chapter 2

Digital Transformation and Access to Scholarly Research: ETD Management and Digital Repository of Indian Agricultural System

Neena Singh

Abstract

The Universities and Institutes of Higher Education and Research has vast intellectual and scholarly research information of student scholarship in form of theses and dissertations, besides other gray literature that usually remains unused or underutilized due restricted access in physical form. Institutional repositories paves the way to hold these valuable information and provides unrestricted Open Access to these valuable research content and maximizes research impact making research more productive. This article discusses the creation and developments of Digital Repository of the first Indian Agricultural University of the country and looks into the transitions made from print Theses and Dissertations (TD) into digital formats, its accessibility and management.

Keywords: digital repository, ETD, institutional repository-India, DSpace, open access, research content, student scholarship

1. Introduction

Timely access to information is crucial for research and development and, transformational learning. In the present scenario, moving towards what we perceive as a knowledge society, faster access to right information has gained higher significance.

The academic community and researchers need fast access to scientific information and achieved scholarly output therefore, digital tools and access technologies are to be exploited /taken up by the information professionals to facilitate the research scholars and look into open sharing of scholarship beyond institutions and libraries.

The universities and Institutes for higher education and research has vast intellectual and scholarly research information particularly the student scholarship in form of theses and dissertations, that usually remains underutilized, these requires to be captured, digitized, transformed to electronic formats and brought to digital

platforms in form of digital repositories. Managing electronic theses and dissertation is major twenty-first century challenge for libraries.

In Indian situation the University Grants Commission popularly known as the UGC which is a regulatory body for academics system mandated in the year 2009, the submission of academic research content of students across the universities in digital formats with aim to facilitate open access to Indian theses and dissertations to academic community worldwide [1]. The concept of promoting electronic versions of research scholarship was to ensure easy access, achieving, and to overcome some serious problems of duplication in research and deficient quality resulting from less visible and unseen factors.

Henceforth, the universities were also mandated to submit the electronic versions of students scholarship to centrally maintained digital repository, the Shodganga (hosted at INFLIBNET Center, Gandhinagar Gujart) that serves as the National Repository. The Indian Agricultural Universities and Research Institutions have separate a Digital Repository of rich accumulated knowledge in Agricultural and Allied Sciences, the Krishikosh, (hosted at Agricultural Knowledge Management Unit, Indian Institute of Agricultural Research, New Delhi) this repository has electronic records of rare books, reports, conference proceeding, bulletins besides the ETD's. Krishikosh also provides a ready software platform to implement all aspects of Open Access policy similar to cloud service allowing individual Institutions to self manage the repository with central integration and hosting.

Shodh Ganga [2] and Krishikosh [3] the two National level Digital Repositories facilitates the libraries of different universities and institutions across the country to upload their intellectual and scholarly output of student community without having to bother much about the maintenance of the IT infrastructure and upkeep of the repository.

Many universities took digitization projects to digitize their old physical research resources or the paper copies of theses and dissertations submitted by students for inclusion/uploading in digital repositories that offered central hosting. The Libraries of Universities and Research Institutes having sound IT infrastructure created their own Institutional Repository to provide online access to their institutions publications as well students Scholarship.

The Indian Institute of Sciences, Bangalore established the first Open Access Institutional repository in the year 2002 named ePrints@IISc using e-print applications [4] later following the trend a number of Institutional repositories were developed and now its widespread in universities and academic Institutions. This article discusses how digital transformations took place at Pant University by digitization of the physical Theses and Dissertations, rare books and other Institutional publications.

2. About Pant University

The G.B. Pant University of Agriculture and Technology is a beacon of agricultural innovation and progress, it has played an invaluable role in shaping the agricultural landscape of India. The university has historical importance of being the first land grant pattern Agricultural University in the country established in 1960, in the state of Uttar Pradesh now Uttakhand is a symbol of successful partnership between India and the United States of America. The establishment of this university not only brought green revolution in the country but also a revolution in agricultural education, research and extension. It paved the way for setting up of 31 other agricultural universities in the country.

The University Library plays a pivotal role in supporting the Institution and its stakeholder by providing seamless access to the widest possible spectrum of information resources both online, digital, and physical resources relevant to curricular and innovative research needs of the academic community.

The university library's mission is to provide access to learning resources and evolve services that meets the information need of the students, faculty and other administrative staff of the university for supporting the trinity of teaching, research, extension and other transformational learning experience at the university. Also, promote intellectual growth and creativity by developing and maintaining useful collections; facilitate access to Learning Resources, both physical and online resources. Teach effective use of information resources and critical evaluation skills and offer Research Assistance. The library has a collection of over 4.25 lakh learning resources including physical and electronic resources, these includes subscribed databases, consortium resources, access to open resources, and digital repository. The library is hybrid in nature and automated using state of the art tools, open sources softwares and technologies like RFID, Wi-Fi, Quick Response Codes accessible through Mobile devices, POS machines integrated with circulation terminals and facilities like SMS and e-mail alerts. The library has impressive and comfortable spaces for research, quite reading and discussions. The library website is the gateway to the most of the services provided and access to collections through online web catalog/WEBOPAC accessible everywhere.

2.1 Need for digitization of physical theses and electronic submission

The libraries traditionally are store houses of knowledge which includes both acquired learning resources through conventional publication channels and other produced by research scholars of the university in form of thesis or dissertations and project works. These valuable research content generally have limited accessibility being unpublished and remain in the stacks of the library often being unnoticed leading to duplication of research work and even subject to plagiarism. As long as the research resources submitted by the students community are not digitized, such issues are bound to arise. The Indian University Grants Commission (UGC) brought a notification in the year 2009 under minimum Standard and Procedure for award of MPhil and PhD degree mandated submission of electronic version of Theses and Dissertation by research scholars in universities with aim to facilitate Open Access of these valuable research content to the academic community worldwide. Besides leading to easy access and achieving, it would also raise the standard and quality of the research as Open Access to research content, maximizes research access leading to better impact of research and development on scientific innovations.

The move to electronic submission of theses has been a great advantage to the libraries it eases out handling hundreds of paper copies of Theses and Dissertations (TD) which can out rightly be eliminated by moving to digital submission. Additional benefits would include streamlined submission, less paper work for students and reduced processing of TD's through bindery work flow [5]. Libraries have other advantage of saving their shelf spaces and maintenance of physical volumes.

2.2 Institutional digital repository

Institutional Repository of the library is a digital archive of scholarly research work, particularly of the students scholarship, and institution's publications, like

Annual Reports, Project Reports, Manuals developed by university faculty etc. and is accessible to the end users through Open Access platform round the clock.

The in-house Institutional Repository of Pant University was created in 2017 with grants in aid for digitization of physical learning resources from the Indian Council of Agricultural Research (ICAR). The repository was created using D Space, an Open Source Software, it has digitized theses and dissertations of Postgraduate and PhD students from the year 1965–2007, besides university publications, keynote addresses of previous Vice-Chancellors, Annual Reports, valuable Rare Books and other important literatures.

The university library was involved into digitization of physical Theses and Dissertations (especially PhD higher level research work) as early as 2000 under National Agricultural Innovative Project (NAIP) collaborative project, e-Granth funded by World Bank from the year 2000–2007. These digitized content were uploaded in Krishiprabha repository and later merged to Kriishikosh National Repository of Agriculture. The university mandated submission of e-theses in Compact Discs (CD) from the year 2008. Accordingly, digitally born theses from 2008 to 2023 continues to be uploaded in Krishikosh Repository, which is a centrally maintained repository by Agricultural Knowledge Management Unit of Indian Agricultural Research Institute, New Delhi. The Indian University Grants Commission later in the year 2009 brought a regulation mandating students in all universities across the country to submit their post graduate research work or scholarship in e-formats to be uploaded in Central Repository called Shodganaga. Many universities have their own Institutional Repository and are also member of National Repositories like Shodganaga or Krishikosh for better management, access and flexibility of their research output.

2.3 Process of submission, uploading and access management of digital content

The university has formulated certain guidelines for submission of thesis and dissertations that is to be followed by the research scholars.

The student have to present a thesis seminar which is non-gradial before the submission of thesis both at Master's and Doctoral levels with a satisfactory report to Dean, Post Graduate Studies(PGS) /Registrar in prescribed format. The entire research work or thesis, is subjected to anti plagiarism tool i.e. Urkund now Ouriginal as recommended by the university, with overall similarity not more than 20 percent. The research scholars are also mandated to submit a Certificate of Plagiarism check along with their thesis/dissertation submission.

The university, in 2008 mandated the submission of digital copy of thesis and dissertations to the library. Accordingly, the library has to check that thesis submitted is in order and acknowledge by issuing a certificate for receipt of the soft copy in pdf format. The e-theses submitted to the library is further processed for inclusion in the library database and digital repository. Once pdf is received, the university library's documentation section checks the entire content and uploads the documents in the Institutional Repository using SSH file Transfer protocol.

2.4 Digitization of physical theses

The library has rich collection of valuable research content submitted by research scholars of the university since the inception of the university in the year 1960.

These physical research resources in the form of Theses and Dissertations have been untapped and largely underutilized due to closed access or restricted access. Digital tools, technological advances and changing trends have brought paradigm changes in access and management of digital content, achieving and preservation. The digital content of research resources can have unrestricted open accessibility everywhere which would add to the quality of research, avoid duplications, address issues of plagiarism and maximize research access thereby, making research more impactful and productive.

2.4.1 Strategies and procedures

The university library took initiative for creating a database of digitized theses and dissertation using the most popular Open Source D Space-Repository application and hosted it to the Institutional Repository as well as the National Repository of Agriculture, the Krishikosh.

The following strategies and procedures were adopted by the library prior to digitization considering the university guidelines approved by the Academic Council of the university, regarding submission, plagiarism check, intellectual property right and the embargo period [6].

1. The electronic Theses and Dissertation submission format and preservation system to adopt or develop.

2. Select platform to host such as D Space application, e Print, Fedora or proprietary software for ETD submission such as Author café or Proquest ETD administration.

3. Where to host the digitized research content submitted by students or the etc. collections and provide access through in-house Institutional Repository, collaborative centrally managed repositories like Krishikosh or Shodganda or third party platform and to disseminate and provide access to ETD and other digital collection.

4. The format to consider and accept for submission to the repository, look into accessibility, achieving and preservation like pdf, XML formats etc.

5. Look into intellectual property right, plagiarism for fair use, access restriction and embargos.

6. Metadata standards to utilize in cataloging of electronic theses and dissertation and weather to render metadata for harvesting.

7. Develop work flows for life cycle management of ETD in future.

8. Look into access option like Restricted Access, world wide Open Access, fee based access or mixed access.

9. The IT infrastructure and technical support required, look into developing in-house infrastructure or get out sourced.

The digitization project at the university library was carried forward in 2017 taking in to consideration the above and formulated a guideline for the entire process. The scholarly research particularly the physical Theses and Dissertations were digitized on priority followed by digitization of some rare and general books taking care of copyright.

2.4.2 Digital conversion process

The university library started it digitization program in three phases. Starting with the digitization of old physical theses submitted by research scholars of the university [7].

Phase one: Started with World Bank funded project NAIP e-Granth subproject named Krishi Prabaha under which 506 PhD theses were digitized from the year 2000–2007 and uploaded in Krishiprabha later it was merged in Krishikosh Digital Repository.

Phase two: Digitization was initiated from grant in aid from ICAR in 2017, about 9651 physical theses and dissertations i.e. more than 4,00,000 pages were digitized from the year 1965 to 2000 including some Rare Reference books.

Phase three: Digitization of books was take-up, in the year 2021–2022 some 274 general books having 1,16,747 pages within copyright were digitized and included in the Institutional Repository.

2.4.3 Technical requirement for digitization

The digitization process at the university library's was outsourced and subjected to certain guidelines and technical requirements in order to ensure quality scans and consistency in digital conversion, some of these includes the following:

1. The digitized output to be provided in two sets one having Raw TIFF images with spatial resolution of 300 dpi including thumbnail Image of Cover page of each theses or document provided for conversion and the other with enhanced searchable PDF-A format

2. The output to be readable with accuracy and consistency in terms of tone and color with neutral common rendering for all images scanned.

3. The scanned images as sample to be provided in different modes like colored, black and white, gray scale in any external storage media.

4. Raw images not to be cropped, and the entire document to be scanned in totality to maintain original size and shape of the document.

5. The library to ensure that the work area of digitization, and digital equipment like scanners, copy boards etc. are cleaned on regular basis to eliminate any dust or dirt in the digital images.

6. The final scanned digital images of Theses and Dissertations in PDF-A format to be legible with completeness, image quality, page sequence etc. as per the originals.

7. The digital image to be created at higher resolution so as to facilitate OCR conversion to a readable accuracy level.

8. The complete digital images to be provided in external storage media for uploading in D Space open source software.

9. The metadata for the Theses or Documents digitized to be created by library for uploading in the Digital Repository.

2.5 Uploading in repository

The complete digital images or the PDF-A of Theses and other documents digitized are technically checked for image quality, page sequence, color tone etc. by the documentation section of the library and uploaded in the Institutional Repository created through DSpace Open Source Repository application that facilitates to capture digital content, store, index, preserve and distribute the digital materials easily. The digital images in PDF-A format are uploaded to the repository through SSH file transfer protocol.

The university library adopts mixed Access to digitized Theses and Dissertations, these are uploaded in the National Repository of Krishikosh and accessible Open Access. The physical Theses digitized from the year 1965 (research work of first batch) of the university to 2000 are uploaded in Institution's repository and accessible through campus Local Area Network (LAN) as they have not been subjected to plagiarism tools. The repository, besides students scholarship, also has good collection of other digital resources like old university publications, important dignitaries' convocation speeches, conference proceeding, manuals, success stories and some rare books (**Figures 1** and **2**).

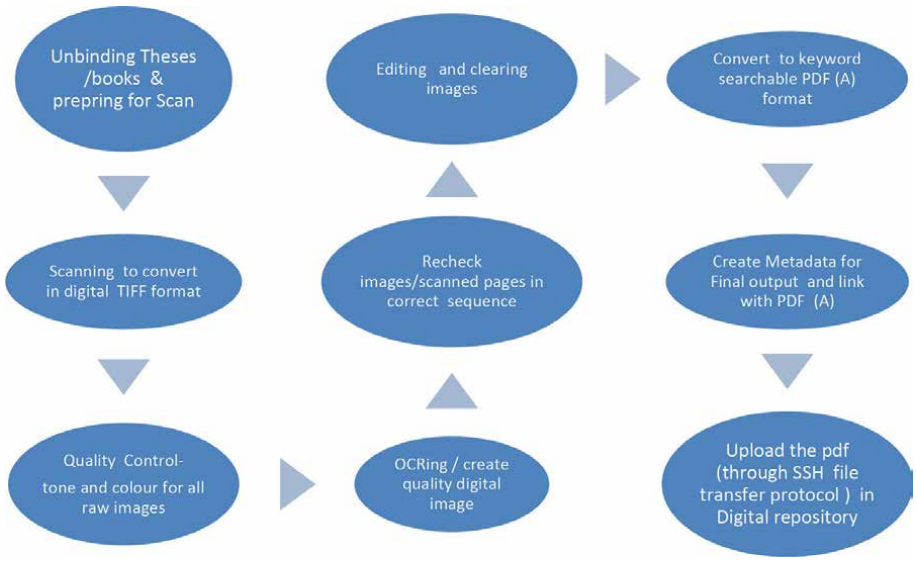

Figure 1.
Digitization process of physical theses and rare books at University Library of Pant University of Agriculture and Technology.

Figure 2.
Screen short of Institutional Repository G.B. Pant University of Agriculture & Technology.

2.6 Digitally born theses and dissertations

The Pant university has been accepting the students research work, theses and dissertations (submitted as part of fulfillment of their academic degrees) in digital formats from the year 2008. These valuable research content is uploaded to the National Digital Repository of Agriculture called the Krishikosh.

The Indian Council of Agricultural Research (ICAR) is main granting body for all the Agricultural Universities in the county in terms of project grants and other development Assistance. The ICAR under its Open Access policy [8] mandated to upload the Institutional publication like research and popular articles, conference proceedings, success stories, case studies, annual reports, technical bulletins, summary of the completed projects, and other gray literatures available with the Agricultural Universities in the country to the Krishikosh Repository. Besides the full content of thesis and dissertations are also to be submitted in the Krishikosh repository after completion of the work (**Figure 3**).

The Krishikosh Digital Repository facilitates decentralized processing and management of research content with central hosting to Krishikosh server located at Agricultural Knowledge Management Unit (AKMU), of the Indian Agricultural Research Institute (IARI), New Delhi. The platform is available to all ICAR Research Institutions and State Agricultural Universities libraries across the country, currently 108 Agricultural Universities and Research Institutes [9] are uploading their publications and research contents to Krishikosh Repository.

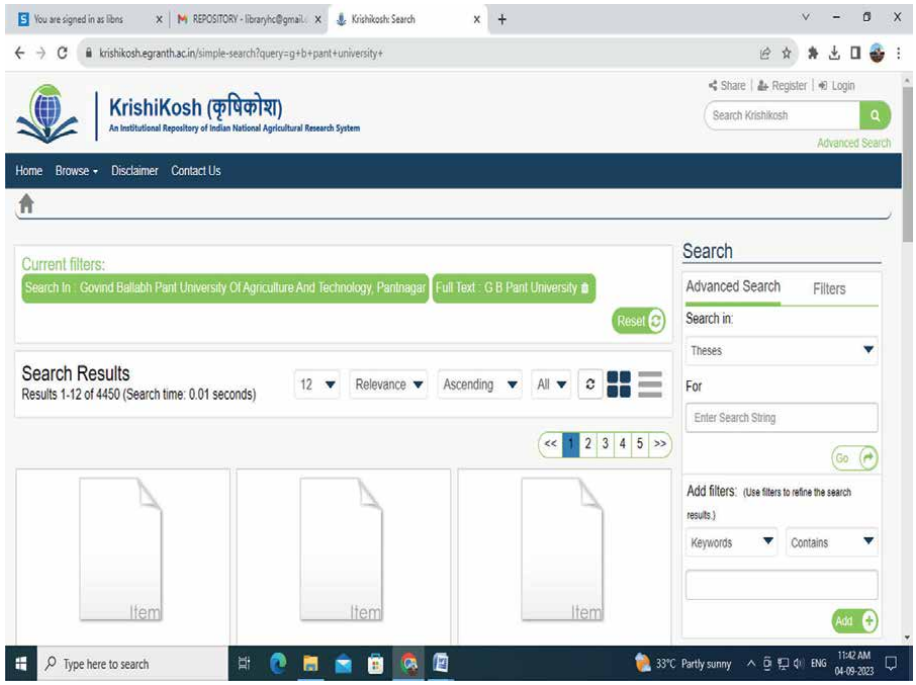

Figure 3.
Screen short of Krishikosh, the Digital Repository of National Agricultural Research and education system (NARES).

2.7 Conclusion

Digital Repositories facilitates quick access to research resources produced by research scholars in universities that usually lies untapped and underutilized in libraries particularly the research content held in physical formats. Technological advances over the period of time brought paradigm change in ways the information is captured, indexed, archived and disseminated over online platforms like Open Access Institutional Repositories or collaborative National Repositories like Krishikosh or Shodganaga.

Digital repositories not only facilitates easy access to research information but also controls the duplication and repetition of human resources and grants. The G.B. Pant University Library took initiative to transit from print to e-resources in 2017 by digitizing it's old collection of rare books and research works including Theses and Dissertation from 1965 to 2000 and 2001 to 2007 in phases. The digital content was included it in National Open Access Digital Repository, Krishikosh. From 2008 onwards digital born theses are uploaded following embargo period of 1 year and accessible to academic community everywhere over the Krishikosh portal. The library facilitates restricted access to rare book collection and Institute's publication through Institutional Repository created under D Space on local server. Digital access to research work is playing important role in keeping check on duplication, plagiarism, maintaining academic ethics and also saving National resources in terms of grants

and human resources. Maintenance and updating of the research contents in Digital Repository from time to time is important activity for sustainability of the Digital Repository.

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Chapter 3

Magic GIFT for Digital Library Innovation with Grouping, Indexing, Folding, and Targeting

Sheldon Liang and Paul Anthony Miller

Abstract

Digital library service is in need of innovation to meet the demands of the modern user and effectively sort through increasingly growing web and cloud content. One such innovation introduces the idea of the magic lamp that can be embodied through three comprehensive views: conceptual foundation, technical roadmap, and operational fulfillment to better serve the user. The Magic Lamp represents a pioneering invention that is both a multidimensional and "smart" approach to discovering, grouping, assimilating, organizing, and delivering archival content while eliminating unnecessary and antiquated sequential search patterns that consume or overwhelm both the user and computer. Central to the concept of the Magic Lamp as a visible icon is the underlying and automated process of the Magic GIFT throughout Grouping, Indexing, Folding and Targeting. The magic of GIFT *enacts* domain-specific search (like "google-it") as grouped, *contextualizes* multidimensional & multilinguals (as indexed) for diverse and global readers, and *dedicates* the user to multi-folded content, and *propels* decent experience and deep exploration on target. As a result, this may be seen in overlying three views that helps streamline large amounts of information in user-friendly ways which are readily available at one's fingertips.

Keywords: magic lamp, cloud intelligence outlets, visual analytical processing, grouping indexing folding & targeting, web-based intelligent service for enlightenment

1. Introduction

Digital library service provides users with eBooks or electronic (pdf-like) documents that are accessible online with ease. However, this service is lacking and needs to be amended/modified or modernized to meet the demands of the modern user and effectively sort through increasingly growing web and cloud content. A proposed digital library is now able to help the user see (or be conscious of what is around the context), seek (contextual discoveries), and search (look into with purpose) that which is accessible for him via the exchanging of information through a terminal device as a *cloud information outlet*. One such innovation introduces the idea of the magic lamp to better serve the user. The Magic Lamp represents a *pioneering* invention

that overlays the conceptual foundation for digital innovation, technical roadmap for digital transformation, and operational fulfillment for multidimensional and manufacturing information service. Essentially, it is an advanced data mining capability structured in a *multidimensional*, *eclectic*, *intelligent* or "*smart*" approach to discovering, grouping, assimilating, organizing, and delivering archival content while eliminating unnecessary and antiquated sequential search patterns that consume or overwhelm both the user and computer.

Both traditional libraries are commonly characterized with massive collections and are often referred to as brick-and-mortar libraries. These libraries face a range of challenges in the modern digital age such as user interface, user experience, and archival content [1]. User interface together with user experience has become an explicitly determining factor of successful libraries. Whereas archival content is the essence of a digital library that ought to provide free access to researchers, historians, scholars, people with print disabilities, and the general public. So then the proliferation of digital content and online resources has led to a shift in how people access information (user interface experience). Traditional libraries need to incorporate digital resources and technologies to meet the changing needs of their patrons. It is, therefore, urgent that libraries be digitally innovated.

There are some challenges and/or dilemmas to present library systems. One such challenge is digital transformation because of the huge number of online archives that lead to information overload. Digital transformation [2] is said to be a reinvention or revolution. As Wayne Busch [3] put it, "Digital transformation is not a series of technology tasks; it is a business strategy for change" The internet provides vast amounts of information, but not all of it is reliably accessed, so contemporary library systems must curate and provide trusted sources of information to help users navigate through the abundance of online content.

Another challenge is accessibility. Accessibility is a good criterion to evaluate successful digital transformation when it is present. However, when it is missing it is much like the limitations of a rampless portal to a wheelchair person. Further, people with poor operating skills are also like those who live in remote areas in that they are limited. So ensuring *equitable access* to library resources for all members of the community can be a hurdle. Thus there is an urgent need for libraries to be digitally innovated with contextuality (*discovered in a context*), interoperability (*information exchanging*), and availability (*at one's fingertips*), or the proposed innovative CIA. This refers to human-computer interaction that strongly affects user interface and user experience. This innovation is the determining factor of successful libraries. As a matter of fact, in management of information systems, management of information systems ought to comply with the "Magical Number (7 ± 2)" according to the cognitive psychologist George A. Miller of Harvard University because of "Some limits on our capacity for processing information". In the reality of information service, we are suffering from such a dilemma that a big piece of information could be fragmented or too big would cause the user to be overwhelmed.

With the proposed innovative CIA, a user becomes empowered through contextuality, interoperability and availability. Contextuality makes him brilliant to reach out for plentiful information from his "arm" [4] reaching out via big data, so that he can categorize them into various groupings. Interoperability helps him feel something out there via operational manipulations, such as indexing and folding. And availability provides plentiful information for him to target for specificity.

The major contribution of the Magic Lamp is its tremendous practical and applicable value for innovative digital libraries through the Magic GIFT which makes plentiful information (or high volumes of data "webpageless" to access. The magic

GIFT breaks down web "borders" among multiple traditional webpages from a few up to hundreds to be virtually accessible. And it transcends traditional separation of webpages to be encapsulated as one. Central to the concept of the Magic Lamp is Artificial Intelligence & Machine Learning (AIM) as a visible gateway to automate the underlying process of the Magic GIFT throughout Grouping (gathering common aspects across multiple chapters/books), Indexing (chaining up the relevances into a "table of content"), Folding (placing multiple sections beneath a web content block), and Targeting (the special interest) in accordance with diverse users' perspectives by delivering the archival content. The well-archived content indexes relevant sections or items to be expandable (to explore) as the user surfs over without swapping webpages. The magic of GIFT enacts domain-specific search (like "google-it") to group archival content as a whole, contextualizes multidimensional & multilinguals to assimilate as indexed for diverse and global readers, and dedicates the user to multi-folded content with his focus on, and propels descent experience to target deep exploration to meet their interest. Consequently, this new approach streamlines large amounts of information in user friendly ways which are readily available at one's fingertips.

2. Magic lamp for innovative digital libraries

The Magic Lamp represents a strategic invention that pioneers *typical* abilities of the modern digital library. In fact, it shapes a *definable* roadmap toward, and exhibits *specialized* characteristics for the modern digital library. Basically, the Magic Lamp leads to a multidimensional and "smart" approach to discovering, grouping, assimilating, organizing, and delivering web-archived content while eliminating unnecessary and antiquated sequential search patterns that consume or overwhelm both the user and computer. Central to the concept of the Magic Lamp as a visible icon is the underlying and automated process of the Magic GIFT throughout Grouping, Indexing, Folding, and Targeting.

The thinking behind the Magic Lamp provides three views/perspectives that define modern digital libraries: First, the *Conceptual Foundation* for digital innovation; Second, the *Technical Roadmap* for digital transformation; and Third, the *Operational Fulfillment* for digital library service as a designed end to its targeted objectives.

2.1 Conceptual foundation: Digital innovation

In the Magic Lamp's conceptual view, the modern digital library results from the brilliant interplay between three components or aspects: Contextuality, Interoperability and Availability. These three come via a set of cloud intelligent services. They are able to *contextualize* cloud-enriched content (CEC) to meet the needs of diverse and global users and readers. They also establish channels for library diversity to *interoperate* meaningfully with each other to bring out volumes of information available with the aim to better serve the user. The Conceptual View of innovative CIA is illustrated in **Figure 1**.

2.1.1 Contextuality for diversified archives

Contextuality denotes/provides the diversity of archived information for the innovative exchange. Diversity can be in types of data and differences in formats

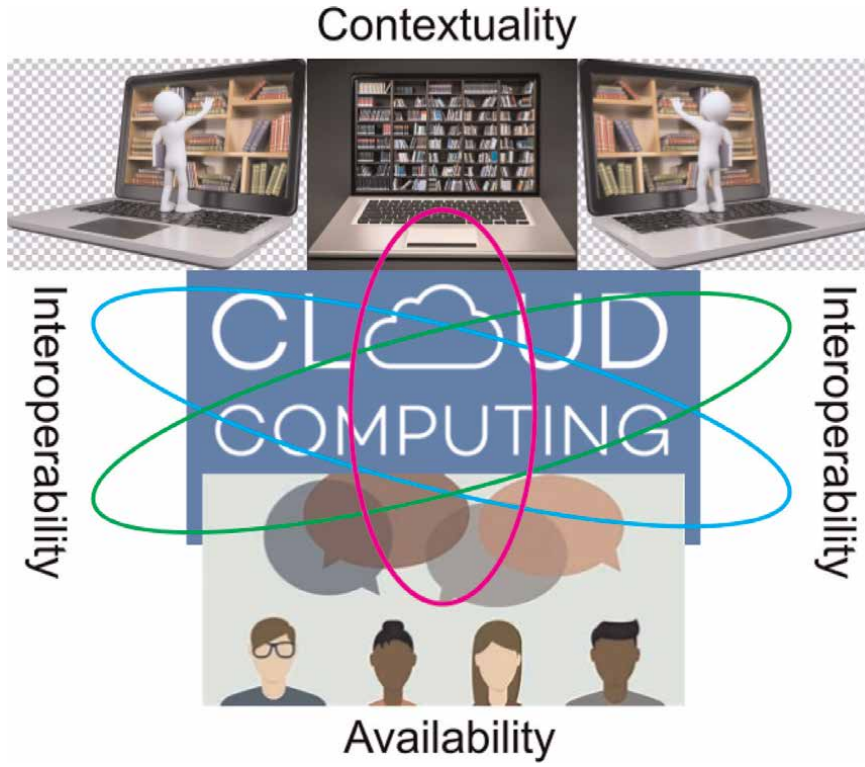

Figure 1.
Innovative CIA for digital libraries via cloud computing. How *innovative CIA expresses contextuality via cloud intelligent service behaving like a knowledgeable librarian who is acutely aware of a user's (patron's) needs. In the center of the illustration, innovative CIA is interactive (as indicated like 3D orbitals) for "cloud computing" to propel collaborative retrievals from the cloud for responsiveness as availability via data interchange. And, the result of cloud generated availability is a more comprehensive service for global and diverse users' needs.*

which should be viewed for innovative purposes like a "holistic ecosystem" that can meet multidimensional needs. With Innovative CIA, contextuality inherently shows the potential power and influence over the meaning or interpretation in which it is presented or observed from various perspectives, such as linguistics, philosophy, psychology, and communication. One particular example of contextuality is that multilingual translation may be provided or available with digital books for diverse and global readers. Therefore, context plays a significant role in shaping how information is interpreted, understood, and used. Thus, contextuality serves as the basis of intelligent interaction through wiseCIO [5]. The following example further illustrates the possibilities of multiple contexts stemming from the same web content., A given biographical book, may be entitled as ① "Who's Who in American History", authored by ②"Tony Miller, M.Ed.", and categorized as ③ "Biography", etc. At least, three applicable criteria could be triggered to enclose the book under three groups. In another word, grouping may not refer to a singular perspective (or unique criterion), but may vary depending on the context that chooses or applies the criteria to grouping.

Figure 2 illustrates how a piece of content (pointed by the red arrow) could potentially be enclosed in multiple diverse contexts. In the example, there are three contexts applicable in support of the user while seeking and searching the same book from ① Who's Who, ② Author, or ③ Biography. Thus the example and illustration

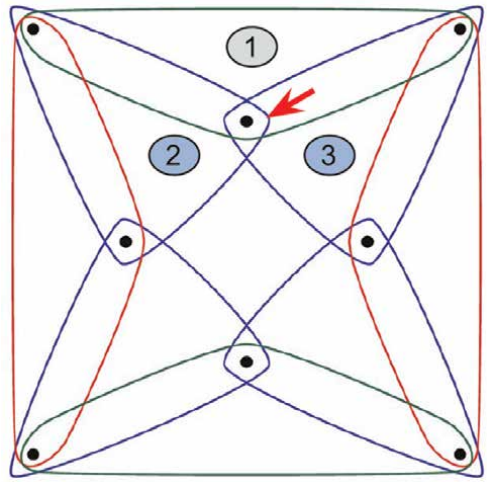

Figure 2.
Diverse contextuality.

Figure 3.
Universal interface fulfilled via interoperability.

portray how contextuality *enables* discoveries in a variety of contexts. It *activates* interoperability (via information interchanging), and *aims* for availability (or readiness at one's fingertips). This helps fulfill the practical function of interface combined with user-centered experience upon which successful digital libraries are determined.

2.1.2 Interoperability for collaboration

Interoperability enables the ability to "socialize" or mingle cloud-enriched content in an ecosystem [6, 7] for each unique user. If we extend the example to a group of digital books, there would be associative (common-grounded) chapters/sections across multiple books. The common-grounded sections can be mingled "boundlessly" in collaboration or "folds" with ease. In light of networking development, interoperability refers to the ability to liaise with different systems, software applications, or components and seamlessly unify them eclectically through data interchange, utilizing information effectively.

Figure 3 indicates how interoperability can glue/cohere multi-diverse contexts together to ensure that disparate systems can communicate, collaborate, and share

data without encountering significant barriers. As a result, interoperability empowers contextuality by making diverse systems and data homogeneous. Thus interoperability plays a key part in the universal interface process across different media and kinds of data much like a facilitator.

2.1.3 Availability for better service

Availability [8], partnering with contextuality through interoperability, aims to make plentifully cloud-enriched content accessible (usable), available (useful) and actionable (used for decision-making) to better serve the reader/user. It is availability that retains the user and makes him engage with exploring, reading and enjoying (digital content). In terms of executable service, the magic lamp determines availability, which is the degree to which a system, application, or service is operational and accessible when it is needed or expected to be used. It is a critical aspect of innovative CIS function which ensures that users can access and use technology resources without disruptions/barriers, as Illustrated in **Figure 4**.

The Cloud Intelligence Outlet [9] (CIO) has succeeded with Anything-orchestrated as a Service (XaaS) that is primarily responsible for user-centered experience, to make the users feel great about usage of digital libraries while exploring and enjoying digital books. Availability is the difference maker via actionability to assist the user to make choices. XaaS is a broad term that encompasses various cloud computing and service delivery models where different types of services are provided over the internet. The "X" in XaaS can stand for anything, indicating the wide range of services that can be delivered using this model. XaaS is part of the broader trend of moving computing resources and software applications to the cloud.

As was previously stated, innovative CIA takes enriched contexts from such diverse perspectives as linguistics, philosophy, psychology, and communication for its innovation. And, extraordinary consideration is given to (a) "The *Magical Number* 7 ± 2" [10] and (b) "*Learning Pyramid*" [11] as heuristics that are utilized to reframe contextuality, constrain interoperability, and enable availability. Innovative CIA is enhanced with more intelligent ingredients attached to retrieved web content blocks (WCBs), and empowered with machine learning automaton to automate the underlying process. The Magic GIFT directs deliveries of well-archived content as WCBs throughout Grouping, Indexing, Folding, and Targeting in accordance with diverse users' perspectives.

Figure 4.
User-centered experience embodied as availability.

Figure 5.
Vertically, a webpage allows 8 blocks, while it splits into 366 pages.

2.1.4 Magic number and heuristics

"The Magical Number" theory/concept (by the cognitive psychologist George A. Miller)/suggested that there should be "Some Limits on Our Capacity for Processing Information". This reasoning still prevails and significantly impacts traditional web presentations. Traditionally, most webpages are presented with 8 blocks of web content or less, but with content splits into lots of subordinate pages by number-indexing for further access.

Figure 5 shows/illustrates an example of traditional presentation that allows each webpage (*vertically*) to be confined into eight content blocks, conforming to the with "The Magical Number 7 ± 2" is accepted reasoning. However, a large number of content blocks will be split into (*horizontally*) up to 366 indexed pages, which becomes a disadvantage because it fragments the whole content in too many pieces.

"The Magical Number 7 ± 2" refers to a concept known as Miller's Law that has dominated fields in software engineering, management of information systems, and web presentations for years because of its common recognition of "Some Limits on Our Capacity for Processing Information". Miller's research suggested that the average person can hold about seven (plus or minus two) items in their short-term memory at any given time. This means that people can generally handle between five and nine pieces of information in their working memory. However, it could also be utilized in a stiff and rigid means by which we might have complied with the limitation onto the published context, which becomes a potential drawback. For instance, on each given webpage, a user can only see a certain number of content blocks without being able to select out of a big range. With a large number of WCBs collected as a Jetstream, the contextuality of the innovative CIA enhaces the range for the user to select, and then enables Magic GIFT to help the user selectively focus on specific groups, which applies the Magical Number in a more gracious way to better serve the user.

The advantage of Innovative CIA over traditional sequencing is also seen in the "Learning Pyramid. "The Learning Pyramid r is known for "active and *engaging* learning methods [that] tend to result in better retention rates". Innovative CIA leverages the principles of the Learning Pyramid to enhance retention by providing multidimensional

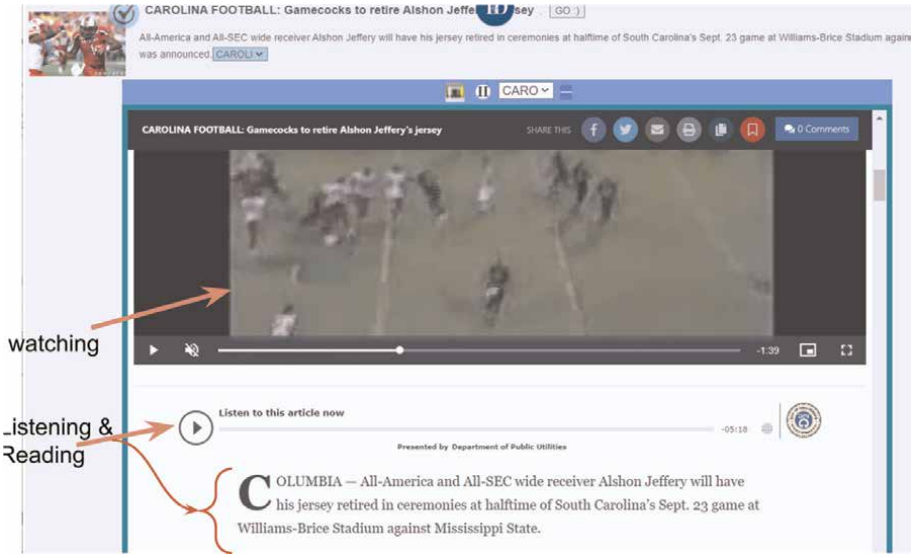

Figure 6.
"Learning Pyramid" inspired news report via enriched multimedia.

media, such as the use of text, audio, and video to report content such as the news as a whole. Digital libraries can be inspired by the "Learning Pyramid", and/directed to actively turn text-intensive books into/electronically enriched multimedia. While watching or listening to reinforce memory, the user is devoted to the content with others to solidify by making broader connections in understanding.

Figure 6 borrows an example from the "Times & Democrat" (https://thetandd.com/) to indicate how to apply the "Learning Pyramid" to the innovation of digital libraries. Like a news report in The Times & Democrat, some chapters in a digital book can be integrated with a combination of multimedia, as a whole, with video and audio in conjunction with textual paragraphs. The "better retention rates" could be achieved through *reading* (textual messages), in conjunction with *hearing* (audio), and *watching*, etc.

In the field of digital libraries, the collaboration with interoperability and availability allows the interaction of magic Lamp to, not only help enrich web content of multimedia, but also engage with the established "Magic Number (7 ± 2)" accepted standard. The magic lamp enacts domain-specific searches that are manageable, operable, and manipulatable. In the same way in which most users are familiar with such grouping that they refer to it as "googled it". However, the Magic Lamp becomes the expert to contextualize multidimensional & multilinguals (as indexed) for diverse and global readers because it dedicates for the user's multi-foldaway content by propelling descent experience with deep exploration per the anticipated target. The magic lamp provides users with a neat experience by streamlining large amounts of information in user-friendly ways.

Thus, Conceptual View for innovation would specify modern digital libraries to be defined by innovative CIA throughout Contextuality (what to enclose), Interoperability (how to select) and Availability (way to serve). It also provides considerations to retain readers via "Learning Pyramid" and engage with "The Magical Number" for the sake of better service. Contextuality embraces more (WCBs) for the user to select, and interoperability enables flexible regrouping/retargeting without the user being overwhelmed (*Magical Number*). More importantly, Availability enriches content with multimedia for higher retention (*Learning Pyramid*).

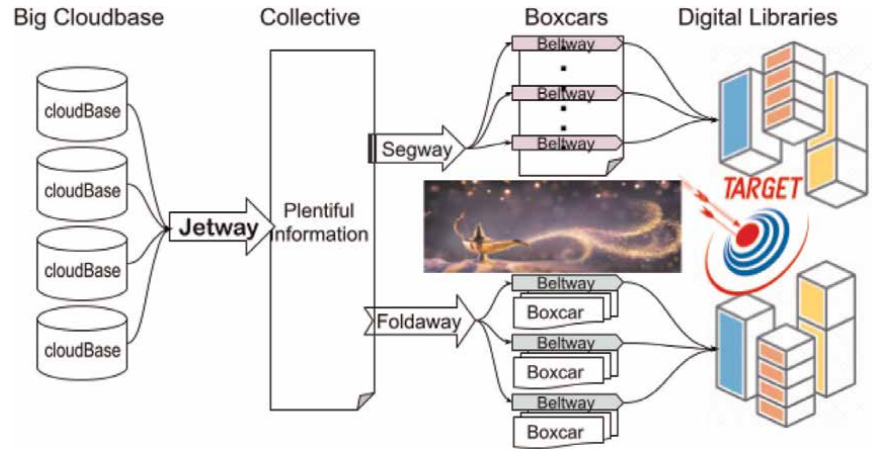

Figure 7.
Magic lamp with definable ways to innovative digital libraries. Where *the Magic Lamp starts with globally distributed online resources that can be seen as big cloudbases (either similar to or different from traditional databases). The Jetway bridges between the big cloudbases and collective plenty, seemingly to form a "borderless Jetstream" of plentiful information flowing over and without frequent webpage swapping. Both Segway and Foldaway help to categorize and specify the collective Jetstream into beltways (to better serve the global & diverse users), and boxcars (enabling universal interfacing). At the end, innovative digital libraries can be established to target the users' diverse goals.*

2.2 Technical roadmap: Digital transformation

Magic Lamp's Technical View points out a roadmap toward a modern digital library through definable ways as seen in Jetway, Segway, Foldaway, and Beltway/ Boxcar. An innovative digital library may seem daunting, but essentially the Magic Lamp simplifies its complexity to better serve the user. The following illustrative roadmap will greatly assist the user to sort through the options of an innovative search. t), Once understood the Magic Lamp is user-friendly and will facilitate users to enjoy exploring, through a highly capable means to meet needs of the most, but the greatest asset of this innovative approach has is that it streamlines plentiful information available at one's fingertips. The Technical View is illustrated in **Figure** 7.

2.2.1 Jetway for to mingle distributed resources

Jetway/Jetstream initiates the first *definable* way through common comparison toward an innovative digital library. A modern digital library ought to offer distributed service via high performance computing (HPC). The hypothetical Jetway, through queries & requests from the user, can be made into a big cloudbase. It also brings out what the user expects as a hypothetical Jetstream that is plentiful, professional, *distributed,* and may also be across multiple (tens to hundreds) of websites. It can be compared to an airport jet-way that leads various people to the aircraft at the "check-in" point where the collective area where passengers arrive before taking off into the Jet stream must comply with specific boarding criteria. It is the check-in point that helps eliminate unnecessary and antiquated sequential search patterns that consume or overwhelm both the user and computer.

Jetway is the way to retrieve web content and transition from distributed to centralized for easy alignment and categorization/use.

Q. Is Jetway against "The Magical Number"?

A. No. even tens up to hundreds of content blocks get collected, but applicable criteria can filter for regrouping/retargeting, which helps shift the user's focus on to a group ~ more to select, and focus on fewer:)

2.2.2 Segway to categorize into sections

Segway describes the second definable way to categorize plentiful information into multiple sections but on a *continuous* basis for an innovative digital library. For instance/example, a year-based criterion/criteria will generate bars to divide the big collectiveness into multiple sections, like the check-out separators/bars at Walmart – Segway divides continuous sections and works as a rapid locator while browsing. The outcomes from the Jetway carry out markups for Segway as place bars to divide continuously. Ideally, the segway bar known as a hypothetical Beltway enables speed-up browsing for rapidly jumping and skipping over content from one section to another.

Segway sorts out a group of continuous content blocks and makes it manageable

Q. How does Segway break the collective into multiple sections on the continuous basis?

A. Most splitting webpages are separately indexed chronologically or segmentally, so a segway is pretty much like Chronological/Segmental bars, which speed up the location of information from one (bar) to another.

It is done with pattern recognition while Jetway is used to retrieve from multiple webpages.

2.2.3 Foldaway to fold up optionally

The *Foldaway* concept installs highly related information blocks in virtual/archival folders according to applicable criteria, e.g., each applicable criterion may be randomly applied to form content blocks that are within that criteria. There may be multiblocks that are logically within the same folder. The Foldaway process "votes/chooses" the top block as a representative (known as a Beltway) to fold them away so that all other blocks become implicit (within the folder). More focused (zoom-in) accessibility can be achieved within the folder through the top-representative beltway.

Foldaway picks up a group of content at random, but/yet complying with the same criterion.

Q. How does Foldaway/determine the criteria to group related content?

A. Jetway helps retrieve useful terms/patterns as heuristics to discover relative criteria for grouping, so multiple blocks of content could be located at random.

2.2.4 Beltway/Boxcar to encapsulate individuals

Hypothetically, both Beltway and Boxcar are utilized to represent the similar idea of an existing webpage via the hyperlink as a content block. A beltway is publicly accessible to the hyperlinked webpage, and the Boxcar (or conveyor box) could be hidden under another Beltway. In general, a Boxcar is equivalent to a content block that is accessible to an existing webpage (via a hyperlink). In particular, a Boxcar is more than a traditional webpage. It is able to act as an intelligent agent to open the hyperlinked webpage via a secondary frame, or to embed it under (the present) via an expanded frame. The Boxcar is intelligent and characterized as follows:

Beltway *individualizes* web content into a webpage associated with its hyperlinks.

- By/through presentation of the hyperlinked webpage subordinate to *the primary context* that will not change
- By/through applying multilinguals for instant translation over the webpage
- By/through embedding to expand the hyperlinked webpage beneath
- None of the above involves webpage swapping
- It may be selected to be folded away as a boxcar in a series of other folded boxcars for accessibility in depth

/// a Beltway is also/functions as a Boxcar performing the above, but a beltway may also be voted as a representative to a group of subordinate boxcars

A Beltway, as a specific Boxcar, behaves as an intelligent and universal interfacing block that consists of an image *Icon* (illustrative of the nature of the content), an *Express* button (to embed plentiful beneath), a *Caption* (Entitled for attention), *Multilinguals* option (for instant translation), a *quickView option* (to bring out a webpage in a separate frames), and a *Descriptive* (information to encourage in depth pursuit), etc., shown in **Figure 8**.

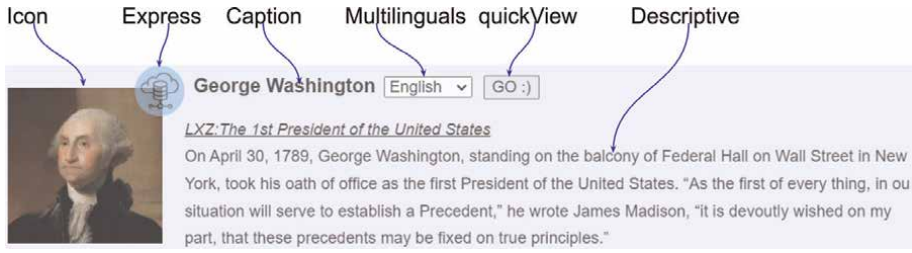

Figure 8.
Individual boxcar acting as a "cart" to carry out functional brilliance.

Beside messages for browsing, a Boxcar is empowered by "Multilinguals" and "Express" – Multilingual enables instant translation to the related webpage if it is permissible, while Express embeds the webpage as an expanded opening for hierarchical exploration in depth. The Boxcar could also be voted/selected as a representative (Beltway) to a foldaway group of related Boxcars. This will be discussed in more depth in the Operational View through the magic GIFT.

2.3 Operational fulfillment: Digital library service

In the Operational Fulfillment, the Magic GIFT may be viewed or generalized as fulfilling modern digital library needs through Grouping, Indexing, Folding and Targeting as innovation. And, the designed end of targeting is the creation of new contextualization that is both user generated and specific. These "opera-characteristics" make digital libraries smart and straightforward and very innovative: These characteristics are significantly *comprehensive,* eclectic & elastic, as well as *web-based* or OS-neutral service.

First, a modern digital library should be a comprehensive aggregation from various perspectives and multidimensional deliveries for diverse users and end results. It should provide significant and impactful/useful ways to better serve users in need of resources from existing libraries. The following diagram (**Figure 9**) will help in

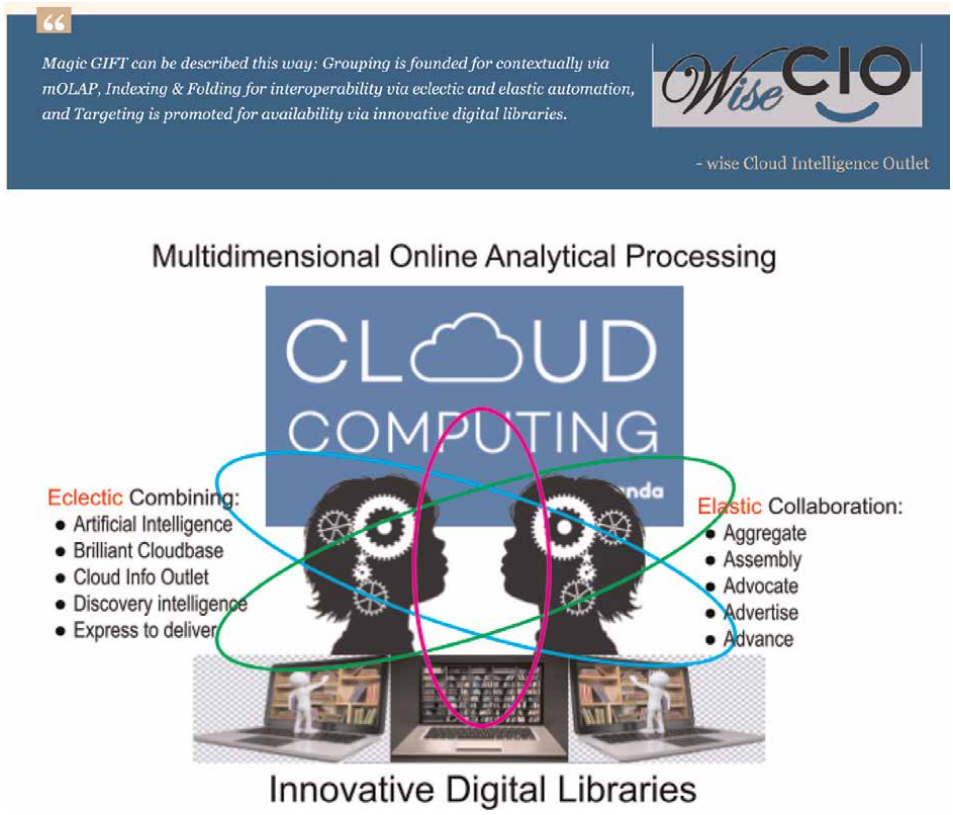

Figure 9.
Innovative digital libraries operated via eclectic & elastic automation. Where *the Magic Lamp, in view of multidimensional plentiful deliveries, operates/opens the Jetway to get Contextuality, then leads to Magic GIFT for innovative digital libraries as a whole. mOLAP turns Contextuality (derived from* ***Figure 1****) as a generalized concept into innovative digital libraries as an operational system of eclecticness & elasticity.*

bringing to view the larger operational view of Innovative wise CIO. The diagram shows the apparent interconnection between (contextuality), technique (Jetway), and operating (mOLAP [12]) in the creation of a new and more feasible approach to modern digital libraries.

Second, currently cloud intelligent services must be eclectic & elastic because of the functional obsolescence of older library arrangements and their limited usefulness. The goodness of it is seen in its wide ranging utility. Being both eclectic and elastic makes for better humanitarian/utilitarian & friendliness/ease of use characteristics that play a key role in innovative digital libraries. Technically, older libraries would lack the characteristics of being eclectic and elastic, having hard coded solutions, so algorithmic machine learning [13, 14] has been introduced for this sake. Algorithmic Machine Learning is a process that depends on sophisticated algorithms driven by the continuously enriched machine learning knowledgebase (MLKb). That is, cloud intelligent service evolves through continuous improvement as the MLKb enriches itself.

Third, a modern digital library ought to be web-based or OS-neutral via a cloud intelligence outlet, so that it is open to typical operating systems, but not dependent/contingent on specific ones, such as iOS, Android, Windows, and etc. With OS-neutrality, all devices can become individual terminals operated via a browser. So, web-based service through Cloud Intelligence Outlets (wiseCIO [5]) helps to innovate and utilize modern digital libraries with ease. It is smart for a user to simply use his device as a terminal via a browser that takes him to the modern digital library.

In the execution of the Magic Lamp, the Magic GIFT engages and aligns with innovative CIO through a technical roadmap and/produces eclectic & elastic operations in distinct ways: *Grouping* (established for contextuality) via mOLAP, *Indexing & Folding* (manipulated or manufactured for interoperability) via robotic process automation, and *Targeting* (promoted for availability) via innovative digital libraries, as a whole, in following aspects:

2.3.1 mOLAP over multiple remote resources

mOLAP is the multidimensional online analytical processing [12] on the remote end in the cloud computing environment that helps to further digitize a library through digital archiving, aggregated content, and transformed analytics (For more information on mOLAP, refer to DATA [15]). It is a remote service for performing multidimensional analysis at high speeds on large volumes of data from big distributed databases. Most business data have multiple dimensions. Similarly, a digital library has multiple categories into which the digital content is broken down for representation and presentation via digital express, tracking, or analysis. For example, library figures might have several dimensions related to authors (title, series, country, and location), time (year, month, week, day), types (novels, legends, politics, and history), and more. But in distributed digital content bases, content sets are stored in databases and webpages, each of which can organize data into just two of these dimensions at a time. mOLAP extracts data from multiple resources and reorganizes it into a multidimensional format that enables very fast processing and very insightful analysis.

2.3.2 Elasticity and eclecticness

Elasticity performing multidimensional analysis involves robotic process automation in elastic/flexible means. RPA is a technology that uses software robots or "bots" to automate repetitive, rule-based tasks and processes in various business domains.

Elasticity in the context of technology, particularly cloud computing and IT infrastructure, refers to the ability of a system to dynamically scale resources up or down based on demand. Scaling is done with RPA. This allows digital libraries (as a business)/to efficiently allocate computing resources to match varying workloads without overprovisioning or underprovisioning. In cloud environments, this is often achieved through services like auto-scaling, which automatically adjusts the number of servers or resources in response to changes in demand. These bots mimic human interactions with digital library systems and applications, performing tasks such as data entry, data extraction, data manipulation, and more. RPA is typically employed to enhance operational efficiency, reduce errors, and free up human resources for more strategic and value-added activities. So, elasticity serves to produce a generalized solution to a family of problems, enables anything as a service for automation, and discloses adaptability or ability to suit different conditions of meeting various needs.

Eclecticness represents/takes methods, beliefs, ideas, etc. From the aggregate, combining whatever seems the best or most useful things from many different areas or systems for the moment, rather than following a single system. As discussed in Section 2, digital libraries ought to be web-based and OS- neutral, which refers to a style or approach that is composed of elements or ideas from various sources, styles, or disciplines. In other words, it involves selecting and combining diverse and often contrasting elements to create a unique and diverse whole. Overall, "eclectic" emphasizes the diversity and inclusivity of influences and ideas to create something distinct and multifaceted. Together with elasticity, eclectic choice helps to better implement anything as a service for goodness/in the moment's need/utility, and elasticity discloses adaptability or availability to meeting various needs.

2.3.3 Innovative digital libraries (iDL)

Innovative digital libraries: an innovative digital library should constitute a global, user-friendly service that interfaces with instant multilingual translation, and provides comprehensive interactivity, in which artificial intelligence via machine learning (AIM) will play a key role. They should remove previous cyber "borders" between libraries (physical library + its website), which made each library able to provide only limited resources. Innovative digital libraries must become borderless so that distributed cloud resources are open to update/regenerate frequently or on a daily basis. The combination of Eclectic and robotic automation will create the flexibly to utilize that which is updated frequently and select whatever technique works best. This process is best expressed in "ABCDE" order:

- Artificial Intelligence (AI) plays a significant role in driving innovation across various industries, so do innovative digital libraries. It does so by enhancing existing processes, enabling new capabilities, and fostering creative problem-solving. From the perspective of cloud computing and web service, AI has a great potential to empower the future of digital libraries

- Brilliant cloudBases in solutions to mOLAP that may not only learn and utilize traditional and relational databases, but also on anything-orchestrated as a service from the cloud computing environment made available with plentiful information through analytics and data mining.

- Cloud Information Outlet (CIO) that provides fulfillment of universal interfacing through Segway, Foldaway, Beltway and Boxcar, and enrichment for user-centered experience especially the overall experience that a person has while interacting with modern digital libraries with respect to ease of use, enjoy-ability, and effectiveness of interaction. This sense of enlightenment encompasses a wide range of factors that influence a user's perception and satisfaction with a particular interaction or interface.

- Discovered intelligence for business, education and entertainment (iBEE) that starts with the innovative CIA through a technical roadmap toward the magic GIFT for better service and decision-making.

- Expressive to express cloud archival repository as a plentiful cloudbase that backs up useful information for advanced deliveries to the destination through grouping, indexing, folding and targeting.

The above-mentioned A through E features help us see how the magic of GIFT *enacts* domain-specific searches (like "googled-it" as grouped), *contextualizes* multidimensional & multilinguals (as indexed) for diverse and global readers, and *dedicates* multi-folded content to users, and *propels* descending experience and deep exploration on target.

2.3.4 Magic GIFT for UnIX

UnIX-CARE [16] has introduced Artificial Intelligence & Machine Learning (AIM) to dedicate mOLAP for the advancement of better service so that digital libraries will be enhanced through their continual improvement via algorithmic machine learning. UnIX or universal interface and experience play a key role in Magic GIFT, as illustrated in **Figure 10**.

Grouping is for discovering common grounded web content blocks (WBC) as a whole by applying certain categorizing criteria, so that a "folder" can be formed through the process of selecting/voting only one block as a "representative". The representative is typically a WCB or expressed as a *Beltway* that helps the reader to focus on the content/or "commonality" of the folder. The user can then mindfully and efficiently find and utilize comprehensive and precise materials in support of his study, research, and reference. The Magic GIFT enacts "must-be-one-fit" grouping based on multiple criteria through dynamic analytics. For instance, with a lengthy list of books, the indicative criteria could be such as Authors (Hosts), Topics/Themes (keyword), and Illustrative Images (visual icons). But, each one retains the ability to offer specific perspectives to diverse users. It is almost impossible without AIM, so AIM plays a key role in Magic GifT (as illustrated as magic lamp in **Figure 10**).

Indexing is for the computational assistance required to link/connect multiple WCBs so that they are bound up and presented in various ways link for use. The "Indexing assistant" is smart, diligent, precise, and capable in its ability to form groups. It is able to group WCBs in three ways; either on a *distributed basis*, or on a continuous basis, or *at random*. The distributed tie is recognized via/by hyperlinks that enable further reference when needed. The continuous tie is observed in that it is naturally laid out in order of one after another. Random ties are discovered relatedly according to the criteria applied to the common-grounded content blocks that may be

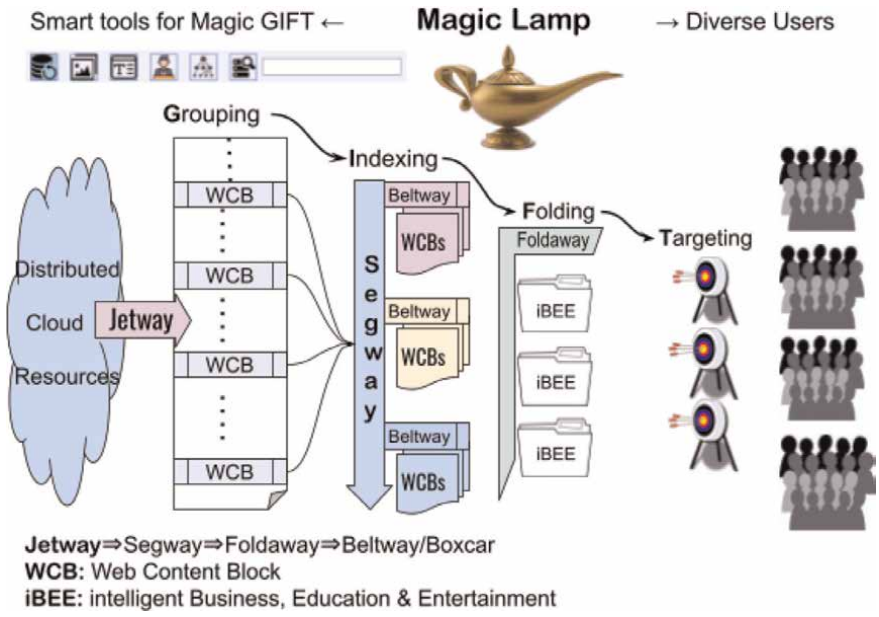

Figure 10.
Magic GIFT for innovative digital libraries. Where *Artificial intelligence & machine learning (AIM) initiates the "magic" process of distributed cloud resources toward useful web content blocks via the Jetway. A web content block is considered useful because critical properties of data have been recognized and/or marked up, such as Theme/Topic of the content, Author/Speaker of the section, and Visual Icon for the block in support of analytical processing through magic GIFT. Thus Magic GIFT enables the intelligence discovered for Business, Education and Entertainment (iBEE) to target objectives to better serve users.*

located across natural categories. An example would be, a series of books retrieved from various distributed cloud resources in which. There is no guarantee that the collection will be gathered in chronicle or alphabetic order. Rather, indexing is smart to collaborate with criteria applied to grouping whether in sequence or series at random.

Folding collects or embodies Grouping & Indexing for two further actions: voting a WCB/Boxcar as the representative for the group, and hiding the rest of WCBs and turning them into a foldaway list. Folding is represented as a Beltway that works as the entrance to the group. We may alternatively use different terms, such as web content block (WCB) vs. Boxcar, Foldaway vs. folder, Beltway vs. Segway, etc. a WCB denotes a content block without emphasizing functionality, However a Boxcar refers not only to a (static) WCB, but also as an intelligent agent. For instance, a Boxcar allows one to open a hyperlink in a separate frame with instant multilingual translation, or to expand the webpage via the hyperlink in an embedded frame, which demonstrates such charming features as universal interface and user-centered experience (UnIX).

Targeting is to fulfill the designed end of GIFT to meet needs of the users by narrowing down the scope during their look-up and seek. Targeting encourages criterion adjustment for re-discovering, re-grouping, re-assimilating, re-organizing, and re-delivering web-archived content while hiding other related WCBs beneath a selected representative (Beltway) to certain perspectives.

Artificial intelligence & machine learning (AIM) plays a key role in Magic GIFT without/additional manual coding. It is easier seen visibly than explained

descriptively, and the operations become more apparent or vivid in some case studies provided below.

3. Case studies on G.I.F.T for innovative web presentations

Innovative Digital Libraries will be thoroughly discussed with case studies. Magic lamp has been described from the Operational View and illustrated with functional interactivity through Grouping, Indexing, Folding and Targeting. These "opera-characteristics" make digital libraries innovative, smart, smooth and straightforward. Three application cases have been selected with specific highlights and will be presented to *orchestrate* typically available and pre-published web content as criteria for the GIFT interchange. They will show how the process prioritizes keywords and topics as specific criteria through dynamic analysis which will propel the user further into tremendously/boundlessly insightful exploration through its innovative capability.

3.1 Well-planned podcast "The Light Network"

The Light Network (TLN) [17] is a long term website for well-planned podcasts. Because of its prolific content over the years, it is a good candidate to showcase the eclectic nature of the GIFT interchange for web based library innovation. TLN is an organized group of podcasts designed to "*encourage your soul, enlighten your mind, and empower your faith*". It is reported that thousands of people from all over the world have heard TLN's content.

Basically, the original website has been well-planned and deliberately posted for a decade. There are a total of 366 separate webpages since 2012 via indexing numbers as references. Each webpage consists of eight concise WCBs with a Title & hyperlink, (a) Topic for the series, (b) Host list, (c) Image Icon, and (e) description-in-brief, and so on. TLN Podcast is a candidate to showcase the powerful nature of GIFT for digital innovation primarily because those informative patterns (a–e) are well-sampled in support of Algorithmic Machine Learning.

Following observable facts disclose the beauty of The Light Network:

Table 1 shows you the well-done job for digital innovation that has retrieved Collective 417 WCBs, mapped to 417 Boxcars that are individually accessible (via the hyperlink), available (applicable via GIFT) and actionable (full of interactivity).

Iconic GIFT	Illustrative significance	Comments
	Collective/Jetstream 417 WCBs	417 Boxcards
	a. Theme Base (15)	15 Beltways (Foldaway)
	b. Host Base (16)	16 Beltwats (Foldaway)
	c. Image Base (17)	17 Beltways (Foldaway)
	Searchable for grouping	Key-Shared Beltway

Table 1.
The light network.

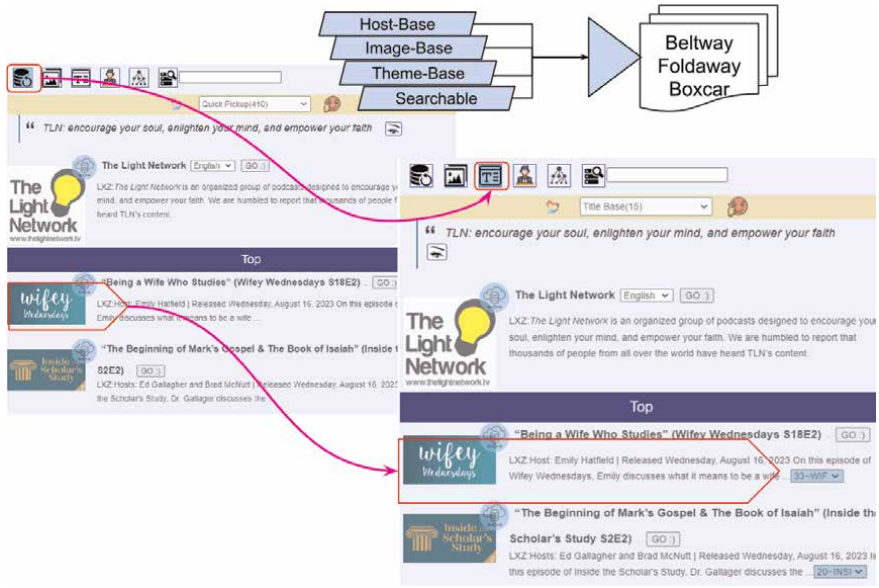

Figure 11.
Theme Base criterion applies to beltway (foldaway).

Practically, THREE criteria applied to the Collective (417), result in Beltways (15-Theme Base, 16-Host Base, or 17-Image Base), respectively.

A user can select which criterion to be applied to grouping so that he can focus on his choice, say, "Theme Base" Foldaway. He can also change his mind of selecting another criterion to be applied through GIFT by resetting the Collective.

A WCB can polymorphically play various roles depending on the applied criteria to Grouping. In the Collective Base, a WCB is a Boxcar (on behalf individual), and Theme-based grouping will turn it to a Beltway leading a Foldaway list (others are hidden under the Beltway), as illustrated in **Figure 11**.

Where Magic GIFT is embodied and implemented by a group of intelligent buttons, so by clicking "Theme-Base" button Collective (417) WCBs turns out into 15 Beltways, and each of which leads a list of Foldaway Boxcars. Taking Theme-Based "Wifey Wednesday" as an example, There are totally 33 blocks under the "Wifey Wednesday". Theme. Since multiple Theme Bases have been deliberately planned, such as "Wifey Wednesday", "Inside the Scholar's Study", and so one, multidimensional analytics will automatically establish multiple Beltways, which turns "antiquated sequential search patterns" to reduced number of rapidly-locatable "buckets".

The Magic GIFT for TLN is said to be "*eclectic*" because its original website has been deliberately planned and diligently presented. While performing retrieval through Jetway from distributed cloud resources (residing in multiple webpages), Machine Learning Knowledgebase (MLKb) is enriched by the well-sampled pattern recognition-in-brief.

3.2 Professional news "The Times and Democrat"

The Times & Democrat [18] is a daily newspaper in Orangeburg, South Carolina. The Times and Democrat is owned by Lee Enterprises, a company based in Davenport, Iowa. Starting June 6, 2023, the print edition of the newspaper will be reduced to

3 days a week: Tuesday, Thursday and Saturday. Also, the newspaper will transition from being delivered by a traditional newspaper delivery carrier to mail delivery by the U.S. Postal Service. Most likely, The Times & Democrat is about to gradually go on digital transformation because of its successful transitioning from the print edition to multimedia enriched news. As the best showcase of "Learning Pyramid" [11] The Times & Democrat utilizes rich multimedia for heuristic retention of readers by providing news contextually in text, audio, and video as well.

The original website has several categories, such as headLine, News, Opinion, Sports, etc. There are totally 160–180 WCBs on a daily basis, belonging to those categories. The Times and Democrat is a professional newspaper that emphasizes diversity of news reports. Different from The Light Network, it seldom has common-grounded WCBs, but each WCB may have associative recommendations while opening a web news.

Following observable facts disclose the beauty of The Times & Democrat (**Table 2**):

Table 2 shows you the professional news through digital innovation that has retrieved Collective 167 WCBs (on a daily basis), mapped to 167 Boxcars that are individually accessible (via the hyperlink), available (applicable via GIFT) and actionable (full of interactivity). Practically, associative recommendation criteria can be applied to all the Boxcars (WCBs) of Collective (167) – When the Boxcar is opened in an embedded mode, the current Boxcar automatically turns out as a Beltway leading a group of WCBs. The original categories via Segway from the original websites result in 4 Sections, such as Headline, News, Opinion, and Sports. A Segway acts like the check-out bar at Wal-Mart that separates multiple sections, and Boxcars are continuously within sections.

Segway can be reflected by segmental and/or Chronological bars, depending on the separators "drained" into the Jetstream – Jetway pulls over distributed cloud resources as outcome in the jetstream. In the case of "The Times and Democrat", Jetway has intelligently brought out segmental bars in the jetstream so that multiple sections have been naturally formed, such as Headline, News, Opinion, and Sports, etc. **Figure 12** exhibits *Professional News* as a good example in discussion of how Magic GIFT orchestrates News Exhibition that was extracted from The Times and Democrat.

Associative Reference is another intelligent feature of Magic GIFT representing decent outcomes through dynamical analytics. When opening the webpage as

Iconic GIFT	Illustrative significance	Comments
	Collective Jetstream 167 WCBs	167 Boxcars
	N/A	N/A
	Associative Reference	Beltwats as going further
	Searchable for grouping	Key-Shared Beltway
	Segway with opening Bar	4 Segways (Bar)
	Collective Jetstream 167 WCBs	167 Boxcars
	N/A	N/A
	Segway with closed Bar	4 Segways (Bar)

Table 2.
The times and democrat.

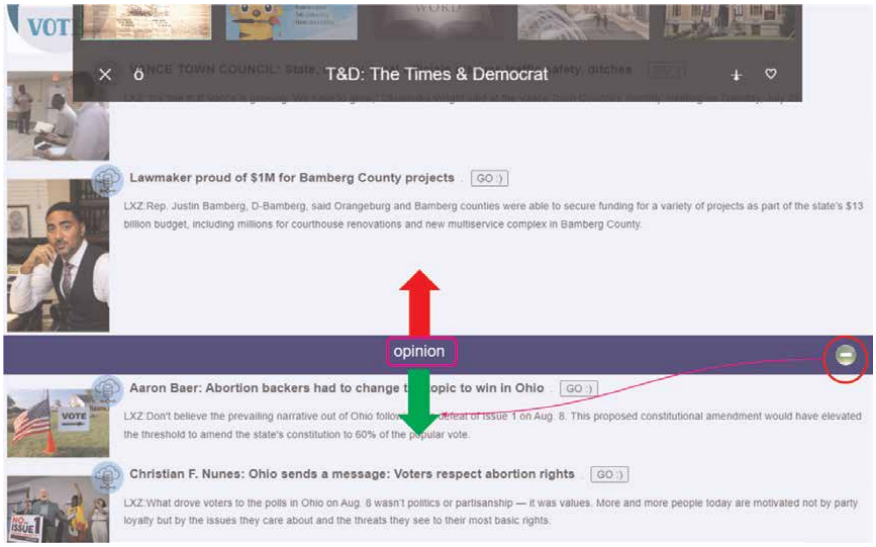

Figure 12.
Segmental bars are made via segway (plus foldaway). Where *Jetstream plants Segways via algorithmic machine learning, and then multiple sections are separated through visual Segmental Bars for further interactivity that promotes sectional span (from one bar to the next), showing/ (−) hiding (+) WCBs beneath, and rapid location, etc.*

embedded under the current Boxcar, the associative recommendation is automatically prioritized for further reference with ease, illustrated in **Figure 13**.

Both Segmental Bar/Segway and Associative Reference are intelligent features of Magic Lamp through deep machine learning and dynamic analytics. Segmental Bar has a twin partner known as Chronological Bar. The former is established on the basis of recognized multiple sections, and the latter on the basis of recognized year, days, or time, which will be discussed in case of WWDC).

3.3 Run-time advocated worldwide developers conference (WWDC)

The Worldwide Developers Conference (WWDC [19]) is an information technology conference held annually by Apple Inc. The event is usually used to showcase new software and technologies in the macOS, iOS, iPadOS, watchOS, and tvOS families, and other Apple software; new hardware products are sometimes announced as well. On a yearly basis, WWDC usually has about 200 WCBs performing showcases via videos and associative reference.

As a sharp and eclectic accomplishment, Jetway triggers intelligent retrieval across 5 years (2023/22/21/20/19) and a Jetstream of 940 WCBs has been formed with Chronological Bar planted. Those chronological bars enable quick sectional leap from year to year, and showing (−) /hiding (+) helps manage yearly accessibility, which is very similar to Regmental Bar in the case of The Times and Democrat.

What we are going to thoroughly discuss is the Theme Base that is intelligently established via statistical wording and analytics over the captions of WCBs. Dislike TLN that has long term deliberate planning, so multiple and practical criteria have been "planted" informatively, WWDC seldom plans the presentation with Theme Base series, Instead, associative reference would be helpful but the large number of WCBs will not be reduced via Associative Reference.

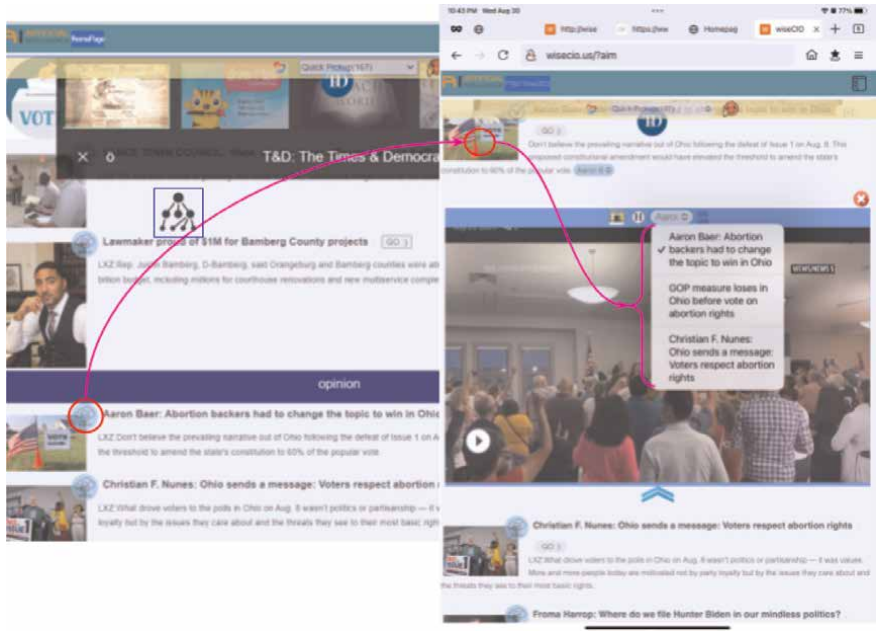

Figure 13.
Prioritizing associative reference. Where *Associative Reference is prioritized as a dynamical foldaway when the associative button is activated. When the Boxcar opens via hyperlink and embed the webpage beneath, The associative reference will simultaneously be discovered and presented in a list, so that the embedment allows smooth transitioning between the primary webpage and its associative without causing the current context to be swapped (as a whole).*

Table 3 A little informative wording processor has been created to label a Theme to each caption. The outcomes are not obvious, but an automated process of statistics and analytics is performed through algorithmic machine learning. In the case of WWDC, Magic GIFT has been proved effective and efficient to reduce a total number of 940 in the Jetstream to 188 WCBs. Together with Annual/Chronological Bars, the analytically processed Theme Base assists Magic GIFT to better serve the users in charming ways:

- The reduced number of WCBs from 940 to 188 helps to observe "the Magical Number 7±2", but is still sufficient for lookup …
- Segway through Chronological Bars help manage the human capability within the given year although it is still much more than 7 ± 2 with 188 WCBs, but under the chronological bar (in the same year), the average number of WCBs is 188/5 = 37.6, which is reasonable to handle.
- Flexibility with more or less, but manageable WCBs offered by Magic GIFT embodies eclectic-city & elasticity for the goodness of better user experience (**Figure 14**).

The innovative WWDC across 5 years shows a great potential that the Magic GIFT can be established via mOLAP to meet needs of global & diverse users.

Iconic GIFT	Illustrative significance	Comments
	Collective Jetstream 940 WCBs	940 Boxcars
	N/A	N/A
	Analytical Theme Base (188)	188 Foldaway Beltwats
	Associative Reference	Beltwats as going further
	Searchable for grouping	Key-Shared Beltway
	Segway with opening Bar	5 Segways (Bar)
	Segway with closed Bar	5 Segways (Bar)

Table 3.
Worldwide developers conference across 5 years.

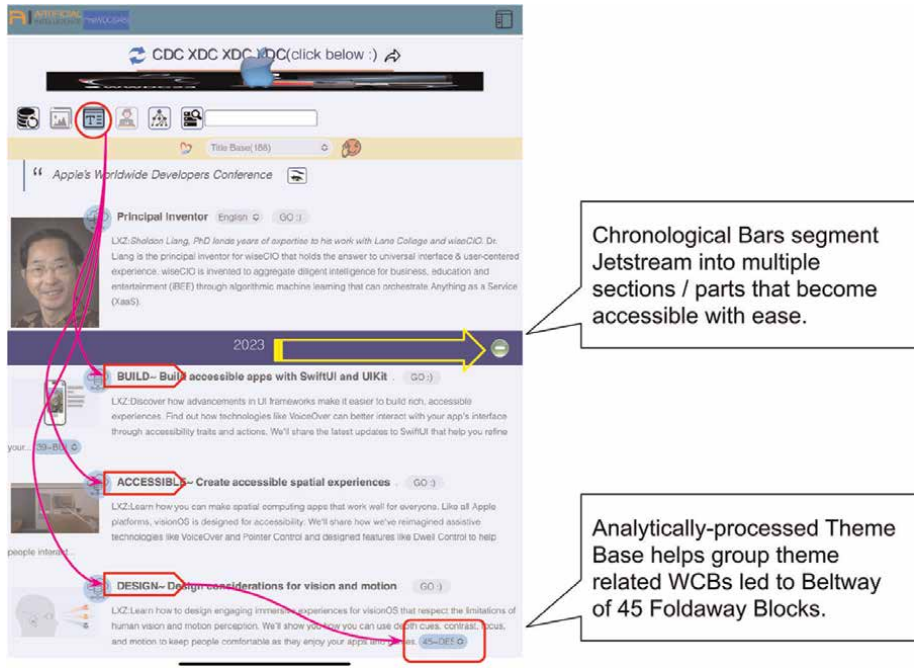

Figure 14.
Analytically processed theme base. Where, besides The chronological bars still help to segment into multiple sections, Theme Base criterion was established through Jetway by utilizing online analytical processing, so that a keyword is strategically elected/selected as a Theme to group for rapid lookup and accessibility with ease.

As sharp studied cases, the above-mentioned showcases have been thoroughly studied and examined, which provides an operational fulfillment of Innovative Digital Libraries: *The Light Network (audio + video)* published as well-planned podcasts, *The Times and Democrat (video + audio + textual reports)* published as professional news, and *WWDC (video + associative tie across multiple years)* as a run-time advocated collection (up to 5 years).

Out of diverse distributed cloud resources, we have chosen many typical websites as directly experimental cases to study with enriched & enhanced web content of multimedia that helps to break down the borders between distributed cloud resources, and smooth transitioning between web content and content for libraries.

4. Conclusion magic lamp for innovative digital libraries

Digital library service is not presently sufficient to just provide users with eBooks or online (pdf-like) electronic documents. It is also in need of further innovation to meet the demands of the modern user and effectively sort through increasingly growing web and cloud content. An innovative digital library should also help the user see (what is around the context), seek (how to discover via interactivity), and search (look into with purpose) with high accessibility f to get into the web content via Web-based information interchange (WBII) through any browsable device that will serve as a *cloud information outlet* (CIO).

Magic Lamp and GIFT interchange is an inventive and pioneering solution to discover, group, assimilate, organize, and deliver archival content in a multidimensional and "smart" approach to better serve global and diverse users. In the meantime/interim, it can also eliminate unnecessary and antiquated sequential search patterns that consume or overwhelm both the user and computer.

A comprehensive look/view of Innovative Digital Libraries (iDL) involves what a digital library means (defining), how to categorize them into types), and the ways space and storage are allocated for them. The Conceptual View shows what an iDL means, the Technical View shows How it works in categories/types, and the Operational View shows how users will better experience allocated results of a brilliant exchange, as illustrated in **Figure 15**.

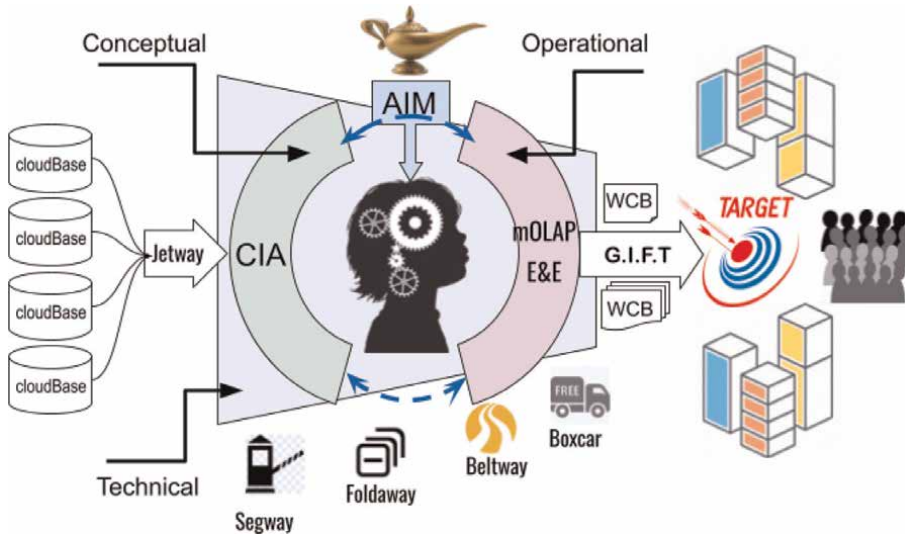

Figure 15.
Multiple views overlaid to for artificial intelligence & machine learning. Where, *three perspectives of Artificial Intelligence & Machine Learning overlap with each other. The overlap begins with Jetway that concurrently retrieves useful information from distributed cloud resources (cloudBases), and directs them through the innovative CIA process. Jetstream course consists of WCBs, or Web content blocks via mOLAP filtering through Segway, Foldaway, Beltway and Boxcar as the Magic GIFT targets the users' objective.*

5. Major contribution

The major contribution of this chapter is its tremendous practical and applicable value for innovative digital libraries through the Magic GIFT, which makes plentiful information of data "webpageless". Jetway mingles distributed cloud resources into a Jetstream that eliminates the barriers between traditional webpages, yet encapsulates them for accessibility, availability, and actionability. Central to the Magic Lamp is AIM as a visible gateway to automate the underlying process of the Magic GIFT which directs deliveries of well-archived content as WCBs throughout Grouping (turning many into a cohesive one), Indexing (relating relevances as a whole), Folding (making foldaways put foldaway), and Targeting (delivering high quality attained "librarian" service).

The Magic Lamp for innovative digital libraries *is the icon* to discover, group, assimilate, organize, and deliver archival content as a whole, especially for diverse and global users. It dedicates the user to multi-folded content blocks facilitating a high degree of focus, and helps the user propel into a decent/well ordered experience for targeting deep exploration within their interest. Consequently, this new approach streamlines large amounts of information in user friendly ways which are readily available at one's fingertips.

AI-empowered Magic GIFT is now available in a reliable, feasible, and multidimensional approach and involves innovative, inventive, and intelligent features that utilize *pattern recognition* (what a WCB looks like with iconic image, title, hyperlink, and/or descriptive) to discover web content blocks, *heuristics* (segmental and/or chronological separators), *statistics & analytics [do you mean analysis?]* (on word counting and indication processing) to enact a Theme Base/or Theme Bases for grouping, *data mining* (discover associative reference while pumping the webpage), and *inquiring queries* (random wording to lookup in grouping).

Any terminal device becomes browsable for innovative digital libraries through The Magic Lamp exchange and will assist the user to explore, enjoy and experience digital libraries. By simply using a browsable device, the innovative CIA is able to transcend various operating systems and, therefore, is contingent on none of them. The magic of GIFT enacts domain-specific search, contextualizes multidimensional & multilingual content that is useful and available for the diverse users, and is very actionable to support decision-making.

6. Practical value and applicable cases

Active use of Psychological Observations and Pyramid Learning represents the pioneering leadership to differentiate degrees of engagement and retention for better learning experiences. The Magical Number (7 ± 2) does not limit the Magic Gift. Its Jetstream can process from tens up to hundreds of WCBs. However, it respects this order in how information is sorted and delivered for the user.

Experimented cases are inclusive of those through which analytical retrieval with Machine Learning Knowledgebase (MLKb) are enriched for typical arts museums, newsagents, and electronic archives Specific cases include the Fine Art Museum- San Francisco (345 WCBs), the Metropolitan Art Museum (1004 WCBs), the Art Institute of Chicago (58 WCBs), The Times and Democrat (167 WCBs), Marquis Who's Who (774 WBCs), the Tennessee Virtual Archive (74 WCBs), The Light Network (427 WCBs), and the Worldwide Developers Conference (940 WCBs), … … [NOTE: You need to use the definite article "the" for specific cases].

7. Future work

Since digital libraries are far from existing ones, there are more library resources for us to discover and traverse the restrictive boundaries through applicable distributed cloud resources. By categorizing existing web content and with the assistance of AIM to data mine via multidimensional online analytical processing, there is/are:

- More sophisticated samples that help enrich the MLKb (Machine Learning Knowledgebase) will be discovered through pattern recognition, so that more content from online libraries will be available without the need for additional coding.

- Typical intelligent strategies will be inspired for seamless integration via generalized algorithmic processes for mOLAP, typically customizable analytics, and elastic process automation as well.

- Adaptability and assemblability will be developed & created to promote hand-in-hand collaboration with library management organization by eliminating barriers within and by collaborating current library systems.

- Sophistication will increase to help users grow their appetite with Magic GIFT for deep involvement with digital libraries.

In closing, Conceptual Foundation developed to help define digital library, Technical Roadmap streamlined to, and Operational fulfillment as Magic GIFT for …

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Chapter 4

Standards and Protocols for Implementing Digital Libraries

David Oguche

Abstract

The success of a digital library is a function of the combination of technologies' standards and protocols used to develop it among others. Standards and protocols are used for determining content, defining structure, facilitating discovery and transmission of data, authentication and displaying information in a digital library. Some of the standards and protocols discussed in this chapter include Content standards which are specifications and guidelines for the creation, presentation and delivery of the digital resources in a digital library e.g. PDF, JPEG, TIFF; Metadata standards which present the rules and formats for creating and exchanging metadata among different systems and platforms e.g. Dublin Core, MARC, MODS; and Quality standards i.e. the criteria and measures for evaluating and improving the performance and effectiveness of a digital library e.g. ISO 9001 and ISO 16363. The chapter also discusses web environment and its characteristics as well as the web technologies that make digital library projects successful.

Keywords: digital library, web environment, standards, protocols, library technology

1. Introduction

Territorial boundaries, which hitherto constitute a major hindrance to information access, are gradually fading away due to developments in information and communications technology (ICT), while traditional constraints of time and space are also disappearing with the influx of digital libraries. Today, libraries all over the world are converting to digital libraries to enable them to provide borderless information services to their clients. A digital library is an electronic library that enables the access, storage and dissemination of information in a digitalised form and represents 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 (AI) and human-computer interaction. While there is no single definition for digital libraries, a typical digital library will have content, organisation, service, technology and people as its elements. One of the purposes of a digital library is to bring about the efficient and effective search in a network of organised digital collections; however, in a real digital library, searching is not enough, hence the main activities of users can be classified into five categories: locating and selecting among relevant sources, retrieving information from them,

interpreting what was retrieved, managing the filtered-out information locally and sharing results with others [1]. These activities are not necessarily sequential, but are repeated and interleaved.

As a collection of digital resources, digital libraries can be accessed by users across different locations and devices. Some of the benefits of digital libraries include: preserving and disseminating cultural heritage, supporting education and research, and enhancing information literacy and access, just to mention but a few. There are certain standards and guidelines to be followed in order to ensure the quality, interoperability and sustainability of digital libraries. This chapter discusses some of the most important digital library standards and their usefulness in creating and developing a digital library. The chapter also x-rays web environment and the technologies that make digital libraries possible.

2. Digital library and the web environment

The web environment plays a very important role in building a digital library, hence understanding web environment is fundamental to understanding the technologies that work in such environment. Web environment is basically used as a computing platform that provides technical ideals for web technologies to thrive through standards and protocols that have made the web successful. It can also be described as a client/server computing architecture, in which the client (web browser) makes requests to the server (web server) for data. The server-side of the web computing architecture provides web users with access to very powerful computers, while the client-side of the web makes the web pages react to user input instantly [2]. These frameworks enable web technologies (which shall be discussed next) to operate in a seamless manner in the web environment. Web environment is characterised by Client/Server architecture; Server-side computing; Client-side computing; Hyperlinking between documents; Standards for creating web pages (HyperText Markup Language (HTML)) and accessing web pages (HyperText Transfer Protocol (HTTP)) that allow web browsers on any computing platform to use the web; Universality of access provided by the internet and internet naming convention; and the Ability to extend medium beyond HTML using browser plug-ins [3].

There are four basic technical ideals guiding the operation of technologies in the web environment and these include: platform independence, separation of contents from presentation, interoperability and conformity to standards [4]. Platform independence is premised on the emphasis that [5–8]:

- websites should separate their content from their presentation as much as possible,
- data and functionality provided on website to users should also be available to external web applications preferably via web services interface and when possible,
- websites should conform to applicable standards, whether they are generic web standards like HTML or industry specific standards like OpenURL or SRU/W (library standards).

It is very important to state that building a digital library and integrating contents require a great deal of web design and development skill and competence because basic web pages support text as well as images and may be rendered differently depending on the hardware capabilities and preferences of the user. Digital Library creators and developers must, therefore, be mindful of the need to create and deliver digital libraries that are platform independent, so that library services provided can reach as many users as possible.

3. Overview of standards and protocols

Standard is a formalised protocol accepted by most of the parties that implement it, while protocol defines a set of rules used by two or more parties to interact between themselves. In the context of this chapter, Standards can be described as the protocols used for determining content, defining structure, facilitating discovery and transmission of data, authentication and displaying information in a digital library. Standards can be international i.e. standards set by bodies like the International Standards Organisation (ISO) and Internet Engineering Task Force (IEFT), it can also be national i.e. standards set by bodies like National Information Standards Organisation (NISO) in the United States or British Standards Authority (BSA) in the United Kingdom. Similarly, standards can also be set by a particular industry or by a single company and accepted by widespread usage [9]. Whatever form or dimension they take, standards are necessary for every aspect of the digital library. Some of the major digital library specific standards are discussed in the preceding section. **Figure 1** shows the classification of digital library standards.

Each of the digital library standards shown in **Figure 2** is described below [10]:

Figure 1.
Classification of digital library standards.

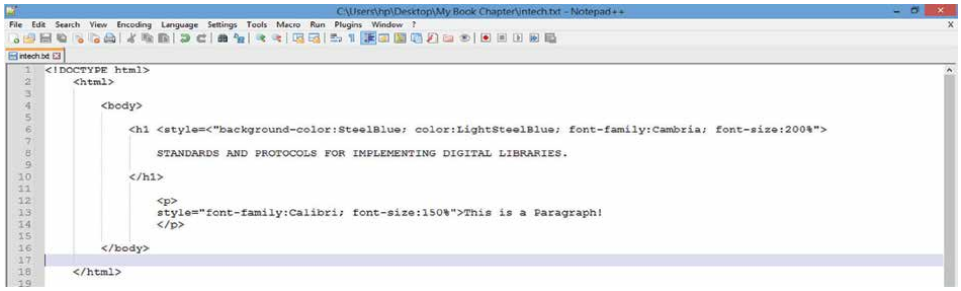

Figure 2.
Basic HyperText Markup language (HTML) code.

Content standards: are the specifications and guidelines for the creation, presentation and delivery of the digital resources in a digital library. They ensure the consistency, quality and usability of the resources, as well as their compatibility with different formats and devices. Content standards can include aspects such as file formats, encoding schemes, resolution, compression, colour, fonts, layout and accessibility. Some of the most common content standards for digital libraries are Portable Document Format (PDF), Joint Photographic Expert Group (JPEG), Tag Image File Format (TIFF), Extensible Markup Language (XML), HTML, Cascading Style Sheet (CSS) and Web Content Accessibility Guidelines (WCAG).

Metadata standards: are the rules and formats for creating and exchanging metadata among different systems and platforms. Some of the most widely used metadata standards for digital libraries are Dublin Core, Machine Readable Catalogue (MARC), Metadata Object Description Scheme (MODS), Metadata Encoding and Transmission Standard (METS) and Preservation Metadata Implementation Strategies (PREMIS). They cover different aspects of metadata, such as descriptive, structural, administrative, technical and preservation.

Protocol standards: are the rules and methods for the communication and interaction between different systems and components of a digital library. They enable the exchange of data, metadata and commands among different platforms and applications. Protocol standards also facilitate the integration and interoperability of digital libraries with other networks and services, such as the web, the cloud and the semantic web. Some of the most important protocol standards for digital libraries are HTTP, File Transfer Protocol (FTP), Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH), Z39.50, Search/Retrieval via URL (SRU) and Representational State Transfer (REST).

Quality standards: are the criteria and measures for evaluating and improving the performance and effectiveness of a digital library. They help to assess the relevance, accuracy, completeness, timeliness, reliability, usability and user satisfaction of the digital resources and services. They also help to identify the strengths, weaknesses, opportunities and threats of the digital library, as well as to plan and implement strategies for its development and enhancement. Some of the most relevant quality standards for digital libraries are ISO 9001, ISO 16363, ISO 16919, DLF DQM and DLF MQF.

Policy standards: are the principles and norms that guide the governance and management of a digital library. They define the roles and responsibilities of the stakeholders, such as the owners, creators, providers, users and regulators of the digital resources. They also establish the rules and procedures for the access, use, sharing, licencing, copyright, privacy, security and preservation of the resources.

Policy standards can vary depending on the type, scope and purpose of the digital library, as well as the legal and ethical frameworks that apply to it.

Ethical standards: are the values and principles that inform the ethical conduct and decision-making of the digital library professionals and users. They reflect the respect for the rights, dignity, diversity and interests of the human and non-human actors involved in the digital library. They also promote the social responsibility, accountability, transparency and integrity of the digital library. Some of the most influential ethical standards for digital libraries are the International Federation of Library Associations and Institutions (IFLA) Code of Ethics, the American Library Association (ALA) Code of Ethics, United Nations Educational, Scientific and Cultural Organisation (UNESCO) Ethical Principles for Library and Information Services and COAR Values Statement (**Figure 3**).

Protocols are predefined rules that govern communicating over a network. These rules must be followed by every system participating on a network. Protocol has been defined as a set of rules or conventions formulated to control the exchange of data between two entities desiring a connection [9]. They are required to define the exchange of control information between user device and the network. The basic elements of a protocol include data format and signal levels, control information coordination and error handling, and timing. Since digital libraries operate on the network, the internet or web to be specific, digital library creators or developers must take into consideration appropriate protocols for such project. Prominent among several protocols is the HyperText Transfer Protocol (HTTP) that defines two main concepts, namely; how client requests are relayed to servers and how servers respond to client requests. The request must specify the following four items [11]:

a. The Uniform Resource Locator (url) for the resource that the client wants.

b. A method, such as GET (which is used to fetch data from the server) or POST (which is used to send data that need to be updated on the server).

c. A list of headers (Request headers may contain miscellaneous information about the client or the resource that they have requested, such as the client browser name, operating system, message size, time and date of request, access control information/credentials, etc.).

d. The body which contains the information that the client wants to send to the server.

Figure 3.
Output of the HyperText Markup language (HTML) code in **Figure 1**.

Protocol		Use
Transmission Control Protocol	TCP	For establishing a connection between two devices on the web and managing the delivery of data packets
Internet Protocol	IP	For transferring data packets between two devices on the web
User Datagram Protocol	UDP	For establishing a connection between two devices on the web
File Transfer Protocol	FTP	For transferring files between the client and the server
Simple Mail Transfer Protocol	SMTP	For sending e-mail messages to the server
Post Office Protocol	POP	For fetching e-mail messages from the server
Simple Object Access Protocol	SOAP	For sending XML messages via HTTP

Table 1.
Common web protocols and their uses.

Some of these standards and protocols are specifically discussed in this section. **Table 1** shows a list of some common web protocols and their uses.

4. Web technologies for digital library implementation

Web technologies are the various tools and techniques that are utilised in the process of communication between different types of devices over the internet. It can also be defined as methods by which computers communicate with each other through the use of markup languages and multimedia packages [12]. Digital Library developers have utilised these technologies to build successful digital library projects that have stood the test of time for content integration service delivery. For instance, most of the successful digital and virtual libraries are built with combination of these web technologies and the same can also be said of engaging the library websites deployed by so many libraries around the world. Some of these web technologies and what they can be used to achieve are discussed below;

HyperText Markup Language (HTML): it is the web technology that describes the conceptual part of a web document or page i.e. the title, headings, lists, paragraphs, etc. It is a client-side language that is used to code the frontend of a website. It helps developers and content integrators to define how the webpage will be structured, and it does so with the help of elements that are identified by tags. Below is a very basic example of a piece of code written in HTML:

Each item enclosed in the <> brackets is an element. DOCTYPE, however, is just a declaration which communicates to the browser that what it is about to load is an HTML document. The <body> element defines all the content that forms the body of the document. <h1> and indicate the start of a heading and a paragraph, respectively. </body>, </h> and are closing tags. They indicate where the body, heading and paragraph end.

In this example, the style attribute is used to assign a particular background colour, font colour, family and size to the text. It can be extended further to include

font style (bold, italic, etc.) and alignment (centre, left, etc.). Other attributes apart from style can also be used to modify elements in a similar manner. A solid background and knowledge of HTML and its variants remains an indispensable skill for digital library creators or developers.

Cascading Style Sheet (CSS): is one of the most fundamental web technologies used basically to beautify the appearance or look of a web page. To further beautify library contents on portals or websites, digital library creators or developers can integrate CSS into HTML code. Using CSS provides an elegant way to change the fonts, colours and layout of a website from a central location. It also allows more flexibility for displaying a web page on the part of the web browser. Instead of applying certain styles to certain elements of HTML code repeatedly, CSS can be used to streamline the process of styling pages across the entire site to save time and energy. Once a style sheet is prepared with all the default font styles, colours and other characteristics related to the overall layout of a webpage, it can thus be applied site-wide. Recently, CSS has also been combined with Bootstrap to design mobile-first web apps.

Web browser: a browser is an application used to access and view websites. It is a software program used to present and explore content on the World Wide Web (WWW). These pieces of content usually include pictures, videos and web pages and are connected using hyperlinks and classified with Uniform Resource Identifiers (URIs) [13, 14]. Web browsers are basically computer programs that make it possible for people to view all the resources that are part of the web. They are based on client-server architecture. Whenever a user enters a URL into a browser's address bar, it relays the request to the server and then fetches and displays whatever the user requested for. Some popular web browsers include: Opera, Mozilla Firefox, Google Chrome and Safari. The two distinct parts of a website are the frontend and the backend. While the frontend refers to all those parts of a website that a user can see on their screen and interact with, the backend refers to the hidden mechanisms that make a webpage function. Typically, a user is generally unaware of what goes on at the backend. **Table 2** gives a list of the two distinct parts of a website.

Web and proxy servers: Web servers are computer programs that run on network operating systems which make web browsing possible. In a lay analogy, web servers can be described as the pots that serve plates requesting for meal. For instance, when users request web page from a web browser, the webserver delivers that file to them

Frontend	**Backend**
Client-side	Server-side
Website design	Databases
UI/UX	Servers
Some UI technologies:	Some backend technologies:
HTML	PHP
CSS	Java
JavaScript	Python
AJAX	Ruby
	NET

Table 2.
Overview of the two distinct parts of a website.

over the internet. In addition to the aforementioned basic function, the webserver organises files on a website; makes redirection from one url to another possible; provides support for uploading and modifying files; encryption of highly sensitive data; customisation of error messages; support for special webserver extensions or modules; authentication to sensitive areas of a website as well as support for web scripting languages such as PhP and ColdFusion. Library web servers are specially configured to authenticated users, as they access various areas of the virtual library and run many applications that are crucial to the delivery of services and digital resources [15].

Proxy server is a web server that acts as intermediary between the web browser and the World Wide Web (www). Proxy server can be defined as a validation tool that uses the Internet Protocol (IP) address of a computer or server at the library to serve as an intermediary between the remote users and the database servers that the library makes available [16]. Proxy servers can be used by library content integrators as well as digital library developers to provide remote access to IP restricted resources. They can also be used to filter access to the web in public libraries and provide a flexibility in logging activity on a library's website. After the proxy server authenticates and authorises the user, it retrieves the restricted resources using the server's IP address and sends it to the user who is browsing from an unauthenticated IP address. In the past, library patrons had to specially configure their web browser to use proxy servers, but URL-rewriting proxy servers, such as EZproxy that require no browser configuration, have now become the norm. In addition to providing remote access to scholarly information, proxy servers such as EZproxy also enrich the relationship between libraries and their users through their ability to assist in data collection that can be utilised in a variety of ways [17].

Relational database: A database is an organised collection of structured information or data stored electronically in a computer system. A relational database is a digital database that relies on the relational model of data [18]. The majority of web applications depend largely on relational databases for organisation, storage and retrieval of data using the Structured Query Language (SQL) for querying and maintaining the database. Relational database management systems (RDBMs) are available in several proprietary and open source manifestations. Oracle and Microsoft SQL Server are common propriety RDBMSs. MySQL and PostgreSQL are the most popular open source RDBMSs.

Common web applications, such as content management systems, wikis, and blogs, often keep their data in relational databases. Digital library applications, such as portals and digital collection systems, store metadata about the resources that they manage in relational databases.

5. Library specific standards and protocols

This section discusses some library specific standards and protocols vis-à-vis how they can and have been used to successfully deploy digital libraries, library websites, library portals and integrated library systems as the case may be Suffice to state that digital libraries are made possible by a combination or mix of numerous technologies supported by different standards and protocols to run seamlessly. Below are some of the library specific standards behind most success digital libraries, library portals, websites and integrated library systems;

Z39.50: Z39.50 is an international standard client-server and application layer communications protocol for searching and retrieving information from a database.

It is a robust search and retrieve protocol that supports a rich set of functions, such as complex Boolean queries, results set that can be further searched, viewing the status of searches in progress, viewing holdings' data, downloading records in different formats and authenticating users. Z39.50 is maintained by the Library of Congress Z39.50 is a complex standard and was not originally intended to run over TCP/IP (the protocol that runs the Internet).

SRU/W: The Search and Retrieve Web service (SRW) and Search Retrieve URL service (SRU) are collectively referred to as SRU/W. SRU/W was developed by the Z39.50 maintenance agency at the Library of Congress to address the shortcomings of Z39.50. Although the service differs from Z39.50 in a number of ways, SRU/W incorporates the lessons learned from Z39.50 to provide a powerful search and retrieve protocol specifically designed to work in a web environment. SRU/W relies on common web communication protocols and is much simpler to implement than Z39.50. The primary difference between SRW and SRU is that SRW communicates between the client and server using SOAP messages, while SRU uses a URL (i.e. an HTTP GET request) to issue a query and the response is in XML.

OpenSearch: OpenSearch is a standard used for finding materials that match a particular information needed by allowing clients to ask a server how queries can be constructed and passing searches using URLs. OpenSearch is similar to SRU but known for its simplicity to implement and returns the results in RSS or atom that can be read with a newsreader. A distinguishing feature of OpenSearch above SRU is that the former is intended for any kind of media, including still images, audio and video.

Open Archives Initiative: The Open Archives Initiative (OAI) is a standard for web content interoperability designed to aid and provide access to multiple digital collections by providing a framework that allows libraries and other service providers to harvest metadata about collections according to rules specified in the Protocol for Metadata harvesting (PMH). OAI is not designed to allow users to interactively search for items that meet a specific information need. Rather, it only provides a simple framework that allows organisations to download batches of records from an archive. Sufficing to state that despite its name, OAI only provides access to metadata about resources it does not provide the resources themselves.

OpenURL: OpenURL is a protocol that refers to an article, book or other resource rather than the physical location of the item on the Web. It was developed by the National Information Standards Organisation (NISO) for use in libraries and other repositories of information. It was turned over to the Online Computer Library Center (OCLC), Dublin, in 2006. Like SRU, OpenURL is a simple protocol that uses a URL to request items. Unlike SRU, the purpose of OpenURL is to supply information for a specific item, while SRU is designed to request an unknown number of items to meet an information need. OpenURL has widespread support in the vendor community and is used for tasks ranging from providing links in citation database, allowing users to request items via interlibrary loan with a single click, to connecting from catalogue records to articles in full text database. In essence, OpenURL defines a few fields that transmit bibliographic information to a web server. Open URL's success is largely a function of its simplicity. However, it can only be used to transmit limited bibliographic information, though the standard is extensible and by transmitting a digital object identifier one can theoretically access any useful information about a resource and connect to it with proper access permissions. Programs that direct OpenURL requests can be directed to appropriate services (known as OpenURL resolvers) and can readily be purchased, though libraries often develop their own. OpenURL is so simple that a basic resolver can be designed in as little as a few hours.

Digital Object Identifiers: Digital object identifiers (DOIs) are strings of case insensitive characters that uniquely identify a resource online. It is a permanent identifier of a web document which consists of two parts: the prefix and the suffix. All resources, which are assigned DOIs by an agency, have the same prefix but the prefix does not change if ownership of the resource is transferred to another agency. All DOI prefixes begin with '10', hence a typical DOI will look like this: 10.23456/1234567890ABCDEFG. It is important to note that DOIs and OpenURL are complementary technologies that can be used in conjunction with a local resolution services to allow users to access a resource. For example, a DOI could be embedded in an Open URL request and, similarly, a DOI resolution service could use a DOI to generate an OpenURL request to a library's interlibrary loan system or a vendor database.

Lightweight Directory Access Protocol (LDAP): There are many authentication protocols, but LDAP is one of the best supported methods to control access. As its name implies, LDAP is a protocol that specifies how directory information can be queried and manipulated. LDAP is essentially a simple version of the complex X500 directory service (hence the 'Lightweight' component in the acronym LDAP). LDAP has become the standard for providing e-mail, phone and directory information. That main function of LDAP is to authenticate users.

Shibboleth: Shibboleth is an authentication standard that allows multiple institutions to share authentication information without revealing personal information. It allows users to access resources maintained by other institutions without the need for a different username or password or a proxy server and protects the anonymity of users preserving both privacy and reducing the risk of identity theft. Shibboleth works when a group of institutions agree to grant access to each other's resources based on user attributes rather than personal information. When a restricted access website needs authentication information, it goes to Shibboleth, which then redirects the request to the user's home institution. The home institution asks for a user ID and password, and Shibboleth generates a temporary name for the user. The restricted access website does not know who the temporary name represents, only that it was issued by a trusted institution. The website then asks the home institution for the unknown person's attributes. If they are acceptable, access is provided. Although Shibboleth is designed to be relatively easy to implement, it has relatively

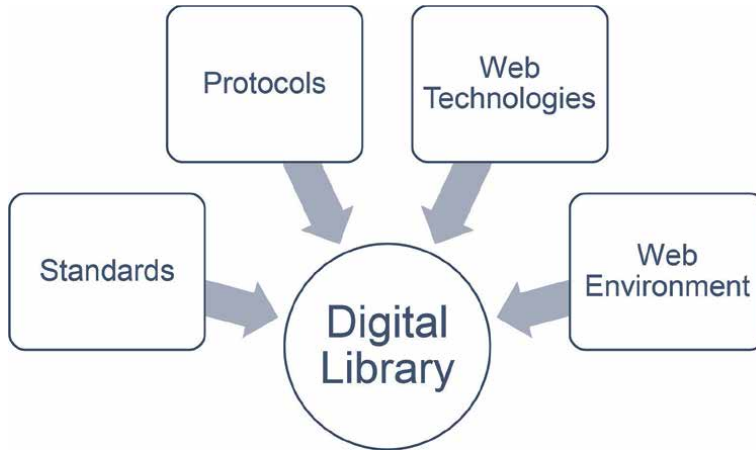

Figure 4.
Combination of technologies that make up digital libraries.

little support from the vendor and library communities, and maximum interest in Shibboleth is from among a relatively small number of major academic institutions.

In summary, a digital library is a mix or a combination of different evolving technologies for seamless information service delivery. **Figure 4** shows the combination of technologies that make up a digital library.

6. Conclusion

In this chapter, the importance of standards and protocols for implementing digital library was discussed. Standards and protocols ensure the effective and efficient utilisation of networked information resources, bibliographic description and interchange of cataloguing data as well as dictating the interplay in a networked information environment. It was established that the web environment also plays a significant role in building a digital library, hence there is the need to understand how the web environment works. A successful digital library would require skill in some of the technologies discussed in the chapter. For library managers and those at the management levels, an understanding of these standards and protocols (technologies) will guide and influence decision in favour of promising digital library projects. Stakeholders in Library and Information Services domain including content integrators and managers must understand the working of these technologies to enable them meet the information needs of users.

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Section 2

Aspects of Digitalization

Chapter 5

Digitalization: An Overview of the Advantages and Disadvantages

Lara Corona

Abstract

Collections are the heart of museums, born for anyone's benefit. In order to ensure people enjoy collections, museums operate as the stewards of items to preserve them for today and future generations. Due to the growing technological improvements and the advent of the Internet, collections have been made available for the audience's benefit, both offline and online. This paper aims to provide the reader with a general picture of the matter. For this purpose, it illustrates the development of digitization since its first steps, when cultural institutions started approaching the usage of computers in the 1960s. Then, this study focuses on the main advantages and disadvantages of digitization. For instance, this practice contributes to preserving items through digital surrogates. Additionally, collections are made widely accessible-albeit virtually- thereby democratizing them. Nevertheless, it is argued that digital content might trigger the loss of the "aura" typically associated with seeing original items due to their uniqueness. Furthermore, digitization is a resource and time-consuming process whose outcome is prone to incurring the phenomenon of rapid "technological quicksand." Finally, this study deals with revenue streams from digital content, such as merchandise and image licensing sale.

Keywords: digitalization, digitization, digital content, accessibility, licensing, metadata, preservation

1. Introduction

This chapter deals with the digitization of collections, also referred to as digitization. At first, the relevance of this topic is highlighted. Following that, the most significant contributions made by authors to the field are presented. Then, in order to avoid confusion, some definitions are provided. Later, the various phases of the digitalization's development are described. Eventually, financial obstacles are encountered, and potential solutions to overcome them are suggested. Ultimately, the chapter illustrates the overriding advantages and disadvantages of digitization as a strategy to increase the accessibility of collections, including those that are stored.

The topic is crucial due to the significance of collections as the very heart of museums. Reasons such as preservation issues, uncontrolled collections development due to thoughtless acquisitions, and lack of storage space have doomed a substantial portion of cultural objects to remain in storage. Given this context, the digitalization of collections may represent a strategy to increase the accessibility of collections,

particularly those that are kept in depots and would otherwise be difficult to access, especially for nonsector people.

According to the International Council of Museums (ICOM), "a museum is a not-for-profit, permanent institution in the service of society that researches, collects, conserves, and interprets and exhibits tangible and intangible heritage. Open to the public, accessible and inclusive, museums foster diversity and sustainability. They operate and communicate ethically, professionally, and with the participation of communities, offering varied experiences for education, enjoyment, reflection, and knowledge sharing" [1]. This definition does not have a direct reference to the digitization process. Nevertheless, it can be argued that digitization contributes to museum goals. Specifically, digitalization may represent a strategy that combines preservation and accessibility. Preservation of collections can be ensured by adopting appropriate storage for collections. On the other hand, museums maintain collections for the benefit of the public so that collections can be used for education, research, and pleasure. Due to the vast number of potentially conflicting factors, it is not always possible to make them physically accessible. Creating an appropriate local environment to preserve collections, for instance, would be of utmost importance if a low-cost, ready-to-use solution were available. Today, technology is of utmost significance to everyone. Even non-tech-savvy people use the Internet and social media on computers and mobile devices as part of their daily life. Similarly, museums have been impacted by these enhancements and can use this trend to promote their collections. By digitizing the collections, it is possible to make collections visible due to technological advancements. Therefore, the relevance of digitization is related to the fundamental functions of museums.

Numerous authors have considered digitization as a possible tool to increase the accessibility of stored collections. For example, a significant study was conducted on the uses of stored collections in many London museums [2]. Despite being undertaken approximately 15 years ago, this study revealed that more than half of the museums that responded offered digitalized collections online. Another research examined the use of digital tools by London-based museums to provide online and onsite visitors with access to information [3]. Another contributor to the field examined the digital world as a personalized interactive experience [4]. Another study compared an onsite visit to an online visit [5]. There are also authors who researched museums' economic profiles [6]. These concluded that museums operate in a complex environment where the decision-making process of cultural entities (such as the setting of prices) is influenced by multiple factors (such as their governance). Another crucial contribution was provided to shed light on how only 5% of collections are displayed in museum galleries for anyone's benefit [7]. Specifically, this study highlights digitization makes 41% of stored collections accessible.

2. Digitization and metadata

In order to gain some understanding of this topic, it is necessary to define specific terms. Digitization refers to creating a digital copy of a physical original, also referred to as a digital surrogate, replica, digital copy, or digitized product of an original analog good [8]. In order to accomplish this, the original objects are associated with computers *via* photography, photogrammetry, or scanning to acquire digital images or substitutes. Digital image processing or digital imaging refers to the process of converting a physical object to a digital format. Due to the absence of conversion, there is

disagreement regarding the inclusion of digital-born objects as a result of digitization [9]. In addition to digital surrogates, cultural institutions may also possess born-digital products and metadata.

Metadata are "structured tags indexing or describing the characteristics of an asset, represented in a metadata schema or standard." They are essential because retrieving content without metadata is difficult. The term "digitized goods" refers to collections housed in libraries, museums, archives, or archaeology locations, and includes both the objects and their documentation. Collections refer to tangible and ethereal cultural artifacts that become intangible upon digitization. Metadata is "structured information associated with an object for the purposes of discovery, description, use, management, and preservation" [10]. This description suggests the existence of a complementary relationship between digital commodities and metadata, indicating that their production and consumption occur simultaneously [11]. It can be argued that digital objects "serve no purpose unless metadata are linked to them" [12]. For example, the Egyptian Museum of Turin in Italy provided fifteen ancient wooden model surrogates and their historical documentation to provide complete information to professionals and nonprofessionals [13]. Some authors have stated that information is more important than the items themselves [14–16]: not only are items meaningless if they lack information but information is more important than the items themselves. This relationship affects their value: the value of digital collections depends on the value of their metadata, which is expected to be FAIR so that they do not vanish or become obsolete [17]. FAIR is an acronym for discoverable, accessible, interoperable, and reusable. Briefly, metadata should have a unique universal identifier and be indexed so that they can be found in searchable resources to be discoverable. Reusability implies that data usage licenses are accessible. Accessible metadata are those whose identifiers permit retrieval. Interoperability is the ability of digital content to "be easily shared between services and users; usable without specialist tools; surfaced in a variety of environments, as well as to manage intellectual property rights and privacy and to secure the integrity and authenticity of content and services" [12].

Metadata should be recorded in accordance with standards so that the same principles are applied universally, regardless of the item, collection, or cultural institution. As reported by NISO, the cultural heritage community employs a variety of metadata standards. Due to its flexibility and simplicity, the Dublin Core [18] is one of the most popular metadata schemas used for a wide variety of collections.

The use of the same standards contributes to the interoperability of collections, as digital collections can be readily aggregated and accessed through more prominent aggregators. These aggregators are very important because they increase the accessibility of collections by linking together collections from all over the world, including those stored: people can access collections from anywhere *via* these aggregators rather than searching through the digital contents of numerous museums. Europeana, an initiative of the European Union [19], is an aggregator that has digitized more than 50 million objects to date. Google Art Project is a second pertinent aggregator.

3. Digitization over time

In the past decade, numerous museums have digitized their collections and made them accessible to the public in various ways. Consequently, the means of appreciating and analyzing them have evolved over time. Collections were made accessible by

selling CD-ROMs; eventually, museum content was disseminated *via* websites. The first commercially available CD-ROM was titled Le Louvre-Peintures et Palais and debuted in 1995. It was a bestseller and included information on 100 masterpieces [20]. After CD-ROMs, museum collections were displayed on their websites. Later, more prominent aggregators were introduced as a different cultural dissemination tool. Most cultural institutions have made their collections accessible online so that they can be appreciated by a global audience with computer and Internet access. The digitization of museum collections began during the latter half of the twentieth century. National Inventory Programme (NIC) was established in Canada in 1972 to create digital inventories of collections using computers [21, 22]. The NIC was renamed CHIN-Canadian Heritage Information after initially consisting of five institutions. The CHIN has assisted museums with documenting and disseminating information about their collections.

In the nineties, however, the most significant shift toward opening them to the general public occurred. In fact, despite being conceived for internal collections management purposes in the form of a digital catalog, museums provided digital content for physical visitors to access high-quality images and information about some items in their collections [14–16, 23]. The advent of the World Wide Web in 1991 encouraged museums to create websites so that online visitors could access their collections. This form of accessible collections was described as a natural and inevitable result of the advent of the Internet, and it has been deemed the result of the marriage between the Internet and digital collections, as well as the demand to make them available.

Despite the reluctance of some institutions, digitalization as a means of enhancing the accessibility of collections has been broadly supported. Due to the concept of actual physical experience and its aura, a form of resistance was identified. This unease primarily involved art museums. According to the European Union, digital content and connected services are essential for the development of industries such as culture and education. As a result, starting in 2006, many recommendations regarding the digitization process and online access were issued to support this claim. In addition, numerous nations worldwide have advocated for initiatives involving digitalizing collections. Several European initiatives exist, such as the United Kingdom's Effective Collections [24–27].

4. Digitization for preservation and accessibility

The digitization of collections has the great advantage of contributing to preserving objects for future generations. Although it is not a method for directly preserving objects, creating a digital surrogate of an item allows for its preservation because the risks of harm associated with their handling are significantly reduced [28]. This argument is fundamental for exceptionally fragile items, distinct (hence irreplaceable) or of high value. In addition to the economic profile, the concept of collection value also encompasses social and cultural values. Consequently, the value of collections is contingent on variables such as esthetic, spiritual, social, historical, symbolic, and authenticity factors. Typically, the selection of items to digitize is based on technical criteria (materials' physical condition), content criteria (uniqueness, significance, and representativeness), and use criteria (materials' demand). Applying these criteria suggests engaging diverse groups of online users to represent a broad spectrum of digitization demand [12, 29]. In addition to preserving objects, digitizing also preserves information when combined with stored administrative metadata, thereby ensuring

accuracy and integrity. In the absence of data, integration is expensive and, in some instances, unthinkable. As a result, it can be argued that digitizing collections enables museums to continue to serve as "stewards of cultural material" [30].

Access to the collections, including the stored ones, is facilitated by the digitization of collections, which represents a further significant advantage. The digital collections are accessible and usable *via* four primary models: online display, proprietary licensing, open licensing, and user-generated art images. Quantitative and qualitative accessibility to collections has increased due to technological advancements [30]. This benefit is significant because it implies that the collections held in storage can be displayed and made known. "Virtual Museum" is commonly used to describe "a digital extension of the museum on the Internet, a museum without walls" [25]. The virtual museum has progressively acquired the connotation of a learning tool [31].

Digitalization eliminates numerous barriers. In the past, only curators, researchers, and academics had access to specific collections. However, digitalization has widened the audience for these collections. Therefore, anyone can access the entire collection at any time, from any location, using any method, and at any hour [32]. Digitization increases the accessibility of the entire collection, including objects that cannot be viewed for various reasons. First, the digital space provides access to items placed in storage for preservation purposes. Secondly, most museum collections are so extensive that the premises are overcrowded and hazardous. Due to these factors, a substantial portion of collections is unseen (or only for research purposes) and destined to be obscure. Another portion of the collections cannot be viewed because it is on loan to other cultural institutions. In addition, digitalization provides widespread access to a global audience comprised of both researchers and the general public, including individuals who would not have had the opportunity to visit collections in person due to their geographical location. Accordingly, it is asserted that digitalization implements the democratization of access and increases the diversity of access opportunities to collections. People cannot view the collections they desire because they are preserved for various reasons and are housed in museums in different countries. In addition, the distribution of collections is not uniform; for instance, the greatest concentration of significant scientific collections is located in the Northern Hemisphere [33]. In addition, it represents a way to engage a new audience because it eliminates barriers associated with geographical factors, access types, financial concerns, and educational qualifications. Online access reduces the so-called opportunity gap, which refers to the disparity in educational opportunities between individuals from different income brackets [34]. In a nutshell, digitizing is a tool for achieving inclusiveness and diversity in museums around the globe. There are no items that could remain inaccessible to the public.

Because digitizing collections promotes inclusivity and increases access to collections, it contributes to achieving the United Nations' (UN) 2030 Agenda for Sustainable Development's sustainable development goals. Specifically, it achieves the quality education objective because it seeks to reduce unequal access due to socioeconomic factors and educational skills and abilities.

To increase online users' access to their digital content, museums should develop descriptive metadata with a high level of accessibility, such as through Google [10]. In addition, it was argued that for museums to make their collections genuinely accessible, they must be willing to abandon their traditional methods of operation to exchange information and operate in virtual spaces. In order to increase accessibility, cultural institutions should adopt policies governing metadata, the true determinants of object interpretation.

Not only does the creation of digital content allow for the display of collections, but it also has the potential to alleviate problems associated with exhibition space requirements. Among other advantages, using technology can reduce the cost of exhibitions [35].

One of the benefits of digital collections is their widespread accessibility. Digital content is likely a potent tool for disseminating culture to accomplish important objectives such as learning, research, and enjoyment. The educational purpose is met if the digital content is a flexible instrument that can be shaped according to the primary characteristics of the different visitors. It means that if the content is too complex for the average person to comprehend, neither the collections nor their metadata is understood, and no educational purpose is achieved [4]. In contrast, a superficial representation of the content is meaningless to academics. Museums can make digital content truly accessible by allowing visitors to select the language, level of detail, etc. In addition, digital surrogates allow the reuse of digital collections so that items, such as the Mona Lisa by Leonardo da Vinci or other masterpieces, can be reelaborated [30]. Digital collections enable it! Indeed, digital users can combine, juxtapose, and construct links between digital objects. The reprocessing of digital content produces social benefits through increased public access to information. Due to the accessibility of collections, there may be an increase in requests for loans. This was the case for the Science Museum of the University of Coimbra, whose loan requests increased significantly after online accessibility was enhanced [36]. Digital content is accessible to individuals regardless of their educational background, location, age, or disability [37].

5. Democratization of collections for everyone's benefit

The digitization of collections is a vehicle for democratization. Accessibility is potentially available to anyone in the world at any time. The only requirements are a computer and an Internet connection. Due to social and economic issues, it could be argued that not every person in the globe has access to the Internet and has a computer. Furthermore, not all regions have dependable Internet connections, as digital content frequently requires high-speed connections. If, on the one hand, it is argued that digitization is an unequal distribution of knowledge because not everyone can afford their own computer and Internet connection, on the other hand, it can be argued that the number of locations offering free Internet connections has increased over the years, including schools, public libraries, airports, and city halls. Additionally, public authorities may provide some economically disadvantaged students with computers for use at home. In addition, some governments periodically distribute economic bonuses to purchase computers. In addition, technological device prices have decreased over time. Similarly, Internet service providers offer a variety of subscriptions at significantly lower prices than in the past. Then, the Internet is widespread in many previously unconnected nations. Since the digitization process is continuous, the number of objects that are accessible will likely increase.

Regarding online users, the new generation is born-digital; therefore, the debate could entail the older generation and the phenomenon known as the generational gap. However, aging populations have embraced technology over time. They can purchase theater tickets, schedule doctor's appointments, and explore museum collections. To communicate with their children during the Coronavirus quarantine, most of

them learned the language with the assistance of younger relatives, in public classes, or independently. In addition, access is restricted to objects that have been digitized to date. Not all existing collections have been digitized due to the immense size of existing collections worldwide. In addition, the digital collections must be updated over time due to occurrences such as new acquisitions and loans. In light of these constraints, digitization may be viewed as a distant beacon on the path to achieving the objective of universal access to collections. However, digitization is an ongoing process, and more and more museums are increasing the number of online-accessible objects.

Due to the lack of boundaries, digital collections may reduce the distance between cultural institutions and individuals. It was argued that the digital content did not constitute a museum in the conventional sense. In order to support this argument, the difference between the physical experience and the online visit was highlighted: only the physical visit was deemed capable of creating a real experience due to the interaction between visitors and the physical space of the museum and its collections; in contrast, the interaction between online user and a museum was found to be limited to a screen; thus, it was defined as a sort of representation of an experience. In addition, the digital content has been compared to museum pamphlets [38]. In addition, a study conducted in 2020 revealed that information associated with collections is provided by the collections themselves and is underrepresented on the Internet [39]. However, there are presently several methods for engaging online users [40]. For example, Wiki, a content management system where online users can revise data to disseminate knowledge, achieves a high level of engagement. They can also include their personal museum experiences and updated photographs. In addition, numerous museums have joined Wikimedia [41]. The Archeological Museum of Naples, which introduced the 2D game "Father and Son" in 2021 [42] illustrates how to increase audience engagement with stored collections. In addition, it was found that the lack of physical space is precisely one of the virtual museum's strengths. The digitization of collections creates an opportunity for those who will never have the chance to visit a physical museum to view museum collections [25]. Moreover, it was asserted that onsite museums provide information within a specific space bounded by the museum's physical borders. In contrast, virtual museums operate in a larger space without boundaries, making accessibility an independent factor from variables such as location, time, and others. The information space provides potentially unrestricted access to information. For this reason, the physical museum is not nearly as effective as a virtual museum. Consequently, it can be stated that technology improves access.

The virtual museum tour overcomes some limitations of the conventional physical visit. Due to the fact that digital collections are displayed in virtual space, many risks to collections are eliminated: not only are items better preserved from physical risks associated with wear and tear and environmental factors such as light and temperature but also security-related risks are eliminated. Moreover, functions such as zoom, illumination control, rotation, etc., enable individuals to observe details that would be difficult to watch during a traditional visit. In addition, digital collections can be viewed when physical access cannot be granted for the reasons outlined previously and during extraordinary events. Despite the outbreak and persistence of the COVID-19 pandemic, some museums, including the Louvre Museum, have seized the opportunity to share their collections online [43].

Visits onsite and online are effective means of disseminating culture. Therefore, it can be argued that their coexistence would be the optimal scenario. Since an online visit can be followed by an onsite visit and *vice versa*, the onsite and online content

can be evaluated in a manner that is not in conflict. They can form a relationship of complementarity with one another. The two can be combined [5]. Furthermore, digitization enables museums to better communicate with the public [44].

6. Digital content versus authenticity of collections

Digital content provides prospective access to the entire collection. It could be argued that digitalized objects lack the authenticity of the originals and debate the irreplaceability of the originals through reproductions. Since the turn of the last century, it has been argued that the copy of original items endangers the uniqueness of products and causes their aura to deteriorate. The concept of "loss of aura" and the resulting loss of cultural value of an object date back to the 1930s and refers to the mechanical reproduction of works of art [45]. It was argued that original objects were considered singular due to their characteristics and irreplaceable because they contained information unavailable in digital content. Moreover, some authors [46] state that the value of digital items is lower than that of their physical counterparts. Nonetheless, the concept of aura annihilation was rejected by a different perspective that viewed digital collections not as copies of original items, but as valuable objects in their own right [44, 47]. Consequently, if, on the one hand, original items of collections can be viewed as irreplaceable goods, on the other hand, digital reproductions eradicate many disadvantages associated with the physical experience, such as the handling of items [4]. This argument is crucial for all of the collection's objects, particularly those whose fragility and light- and temperature-sensitivity make them susceptible to damage during traditional exhibitions. Since most collections are stored, digital surrogates may be able to address their inaccessibility issue. Items destined to remain in storage for preservation purposes could be displayed for the purposes of enjoyment, education, and research. In addition, a broader audience can access digital content while sitting on their sofa at home, as opposed to only those who can appreciate collections through an onsite visit due to the aura of collections. Nevertheless, the digital content does not conflict with the aura because onsite and online visits can be complementary.

7. Financial implications and possible solutions

One of the disadvantages of digitization is its financial viability [48]. The creation of digital content is still expensive and time-consuming. The problem of balancing the need for accessibility with financial sustainability is not new to museums, and they are attempting to find solutions [6]. Digitizing collections necessitates adequate funding, but it accomplishes its goal of increasing the accessibility of stored collections while simultaneously preserving them. Additionally, money, staff, and space are required to store and preserve collections housed in depots. However, museums cannot simply store objects because they hold collections in trust for the public. Collections must be utilized. Because digitization offers the chance to increase the accessibility of stored collections, museums must be able to finance it and discover ways to reduce expenses. For this purpose, the digital content could be reduced to those pieces of collections that online users are more likely to find intriguing. According to this theory, numerous museums have decided to restrict the construction of digital collections, including those that are stored, to a subset of their

collections. Although not all collections are displayed, it is essential to note that not all items of collections are likely to be of interest to visitors, such as repetitive items: museums can display a few of them; what's the point of displaying them all? Does the inaccessibility of a thousand identical copies of the same sample render the accessibility of a few insufficient?

7.1 Items selection to mitigate costs

A proper selection of items to digitize based on some fundamental criteria can reduce the cost of the process, bringing the stored collections to life through digitization. To save money, museums concentrate their efforts on representing the entirety of their collections. To achieve this objective, providing individuals with digital versions of all items is insufficient. In contrast, it means to select items to provide a representation of the entire collection. Therefore, a museum could represent its entire collection by merely making a small portion of its objects available. To accurately represent the scope of their collections, museums must make an appropriate selection of objects based on some criterion. The selection process itself incurs expenses for activities such as establishing guidelines, handling, storage, and transport. Therefore, the selection process should be conducted with caution.

One of the criteria is the physical criterion, which prioritizes items to be digitized based on the accessibility of content, the physical condition of the material, quality, and postdigitization added value. Therefore, the accessibility of items likely to vanish soon may be a factor in determining which items are selected for the digital process. In contrast, potential causes of future inaccessibility of collections include physical deterioration, a lack of old-generation technological know-how, and the replacement of hardware and software systems due to obsolescence [12]. As this characteristic is likely to be a critical factor for storing many items, a large portion of the stored collections should be selected for digitization. Similarly, the storage facility houses numerous items whose physical conditions may threaten their continued existence. For example, fragile objects and documents are susceptible to deterioration due to their handling, also for products that are sensitive to light and temperature. As a result, digital surrogates may represent a method for preserving their memory during storage. However, some items may be so fragile that the digitization procedure is likely to result in additional loss or damage. For this reason, museums may opt not to digitize them, or at least postpone the process until innovative, risk-free methods become available. Some museums digitized the damaged objects to illustrate the "before and after" of conservatism.

After deciding which objects to digitize, museums must consider the quality of the digitization and their workflow and financial constraints [5]. Additionally, the quality of the access content, that is, the digital content, depends on the quality of the associated metadata. Therefore, museums should focus on data entry for both internal and external purposes [49]. It should be of the utmost importance to avoid financial constraints to provide online consumers with complete, high-quality collections. Due to the impossibility, museums may choose to digitize a few pieces of high quality or many pieces of low quality. In addition, they could employ a compromise solution to produce pieces of both poor and high quality. This alternative may mitigate the so-called "digital-divide" between small and large museums, mainly if renowned museums such as the Louvre, Met, MOMA, and Hermitage adopt it [4]. Consequently, digital collections, including stored collections, can acquire value due to their improved accessibility and functionality and the possibility of new relationships.

Unfortunately, sizable digital collections may become unmanageable. At that point, a selection of items to delete will be required. It can be argued that, just as any digital item should be selected in accordance with the museum's collection policy, any decision to delete it should also be ruled by museum policy. Although the selection process raised some concerns regarding the democratization of collections, it could be argued that this presents museums with an excellent opportunity to reconsider the compatibility of objects with their mission [40].

Appropriate selections of items for digitization can affect both accessibility and expenses. The selection should prioritize items that are easily accessible and manageable to reduce costs. Thus, the number of items that can be made digitally available can increase. In addition, as stated previously, repetitive objects can only be represented by a few examples. Then, items that were digitized elsewhere can be eliminated from consideration. Next, although creating metadata and destaining collections can be difficult, museums could select only items with associated metadata to save money by avoiding spending time and money on those without them. Due to the creation of digital content, museums can attain some economic benefits and cost savings. For this reason, museums should choose items that have the potential to pique the public's interest to sell in their gift shops [12].

7.2 Technical solutions

Long-term financial needs are an essential aspect of digitizing collections, as the costs of digitizing include the creation of digital surrogates and the costs associated with their long-term preservation and updating the required expertise [50]. Despite the benefits of creating digital substitutes, digital content has a limited lifespan or shelf life due to its high fragility rate. In addition, digital content is perpetually threatened by the phenomenon of technological quicksand [51, 52]. Due to their susceptibility to degradation or obsolescence, digital collections are vulnerable to loss. Therefore, it is possible to contend that the digital content, designed to preserve collections and make them accessible to anyone at any time, is merely a temporary strategy for making the stored collection accessible. However, museums have adopted migration and emulation as their primary strategies for preserving digital collections and ensuring their accessibility. Migration is the process of transferring data from an obsolete platform to an active platform [11]. Emulation is sometimes favored because it can result in the loss of data or original functionality. Emulation simulates future hardware and software so that digital content can be read on uncertain future systems.

Museums could implement strategies for three-dimensional objects that require enormous financial resources to save money. For instance, these objects could be reproduced in two-dimensional to reduce the economic impact. Increasing the digital process of natural science collections through centers of excellence could be one approach to overcoming technical obstacles. To develop the DiSSCo, the National Museum of Natural History Luxembourg digitized nearly seventy percent of its herbarium specimens in 2020 [33, 53, 54].

7.3 Volunteers

In countries where it is feasible, museums can utilize volunteer labor to increase their digitization rate and circumvent financial difficulties. Volunteers are not typical employees in terms of their skills and time availability. Despite their limited availability, their contribution helps museums continue the digitization process. Volunteer

recruitment assumes the development and management of a well-trained team. In addition to the training provided by museums, the employment of volunteers requires coordination and oversight by professionals with management skills and digital expertise. Volunteering is nonetheless a powerful instrument for involving the community in museum life, as it fosters civic pride and builds stronger communities. In addition, museums may increase the benefits of free collaboration by utilizing specific groups of volunteers, such as museology students, training-ship participants, or previously trained volunteers. In this context, museums promote active engagement by permitting visitors to interact with their collections. To this end, museums have recently shifted their focus from collections to people and increasingly encourage public engagement with collections. The Australian Museum devised a project to digitize its entomology collections with the assistance of volunteers [55].

7.4 Indirect benefits

Museums can reduce the expense of digitization by focusing on other opportunities. The combination of efforts by museums, libraries, and archives may provide a solution [27]. Digitization requires substantial resources, but museums can only generate income by selling image licenses. The public disapproves of these operations because they impede the accessibility of collections that museums should hold in trust on behalf of the people. Despite the lack of direct economic revenues, museums can benefit indirectly from their investments in digital technologies, such as increased attendance, public contributions, and bequests [5]. Due to their positive reputation, museums can benefit indirectly through agreements with other institutions or crowdsourcing initiatives. For instance, museums could turn to technology-leading information providers such as Google that have the financial means to digitize museum collections. In such a scenario, there is a chance that the provider will gain a dominant position over museums, exploit the collections, and produce low-quality content. Therefore, care must be taken in constructing the agreement [30].

According to the ICOM definition of a museum, museums are non-profit organizations. For this reason, image accessibility is generally free, and museums benefit in various ways, including positive visibility, public funding, donations, membership, etc. More and more museums are expanding the number of works that can be readily viewed and reused online. However, some museums do not offer complimentary admission. In Tate's case, the revenues were used to pay for a portion of the digitization procedure [56]. Approximately 800 museums and libraries have open data for online users who desire to access, share, and reuse their collections. Consequently, disseminating collections *via* open data generates knowledge and culture and is an effective marketing strategy. Museum collections are cultural capital, including their held collections [29]. As a cultural capital, collections, including those that are stored, can generate cultural value for individuals through their use. Since open data are provided for free, digital content cannot be evaluated based on its monetary worth when considering open data. These are items whose cultural value exceeds their economic value. If it is not feasible to profit from disseminating knowledge provided by image licensing, this does not imply that digital content has no value.

7.5 Revenues from the digital content

The merchandise market allows museums to generate income from digital content. Some museums sell products directly (images, so no). Print-on-demand services such

as IMS, which stands for the Infinite Museum Store and are provided at no cost to museums, are another method for generating a financial return. This service lets users obtain the desired product while printing content from books and pamphlets [57]. Museums do not deal with advance orders or inventory. The printer service provider handles orders directly, from printing to delivery. Visitors are directly involved in creating the product: they select the item, such as a painting; then, they choose the outcome they desire, such as a T-shirt, mobile cover, scarf, or shopper; and lastly, they provide the delivery address. All of these actions are performed on mobile devices by customers. It is advantageous for museums to increase the accessibility of their preserved collections. Therefore, the value of the collections and the visibility of the museums increase. In addition, museums generate revenue from digital collections without incurring initial costs. This system has thus far been evaluated in art museums, but it can be expanded to all museums [56].

8. Summary of the main advantages and disadvantages of digitization

Digitization of collections is the strategy by which museums actively utilize 41% of their stored collections [7]. **Figure 1** illustrates the primary benefits and drawbacks of this strategy. Specifically, it makes it possible to potentially view the entire collection.

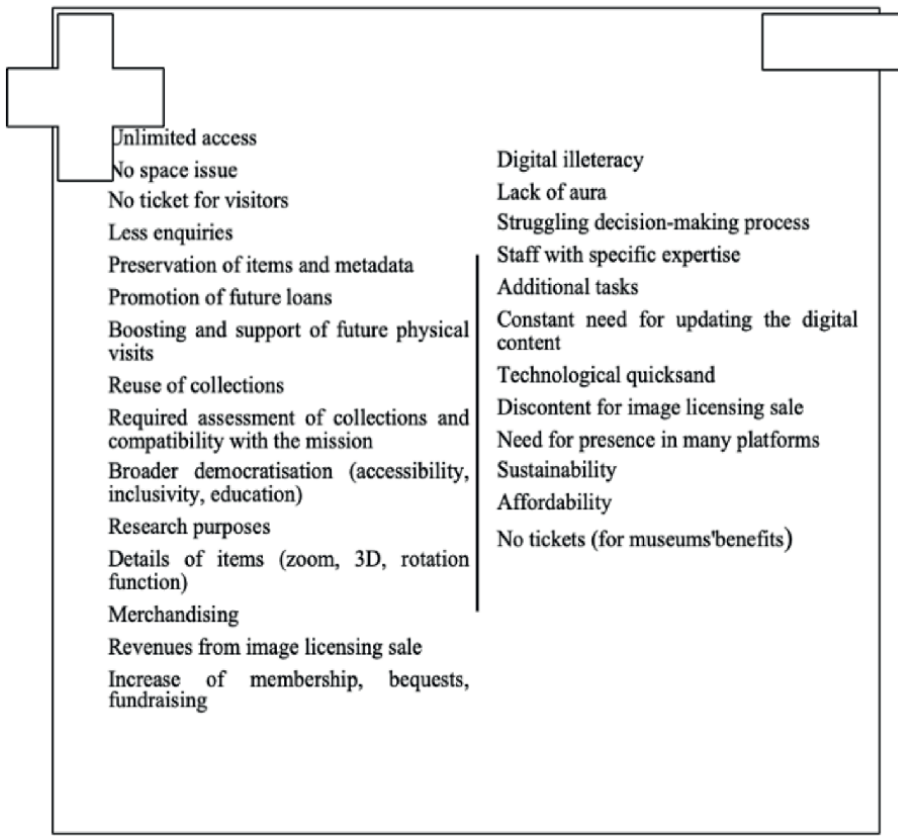

Figure 1.
Main advantages and disadvantages of digitisation (Corona).

In fact, this practice promotes the democratization of collections because it makes them accessible to anyone, anywhere, and at any time (generally financially accessible, with the exception of Internet access), regardless of the current availability of storage space. In addition, making items available in the digital realm may reduce the number of investigation inquiries, resulting in fewer tasks. Reduced exposure to risks, such as handling, light, pollution, security, and so on, contributes to the increased preservation of collections. For these reasons, museums would like to increase their digitalization efforts.

Despite the benefits associated with the decision to increase digitization, there are certain constraints that discouraged the adoption of this strategy to some extent. The lack of sensory accessibility [58, 59], loss of the aura that could affect emotional accessibility [39, 45, 46], and people's social currency due to their status for social meetings [60], are some of the reasons why some people prefer physical visits to museums. People's digital illiteracy may also be a deterrent, limiting the intellectual accessibility of collections [61]. Another argument is that the absence of resources is the most significant barrier to increasing the use of stored collections through digitization. This refers to the insufficient workforce, quantity, knowledge, and budget.

9. Conclusions

According to the ICOM's definition of a museum, museums serve multiple purposes, none of which should be pursued at the expense of another. Equally important are accumulating, preserving, researching, exhibiting, and interpreting. It is essential that all museum collections are accessible to the general public, as they are the museums' very essence.

The majority of museum collections around the globe are stored. A catastrophe in terms of accessibility, considering there are over 95,000 museums worldwide. Even though the majority of museum collections are not accessible to the general public, collections must be viewed, utilized, or at least actively available for use, as they provide no value to the modern public if they are not. Preservation for future generations is essential, but it must be balanced with the benefit to the current generation, which pays for the collections and is responsible for generating interest among future generations. In the past, museums prioritized the preservation and conservation of artworks and other objects over their use. As some curators have been preoccupied with the preservation aspect of their mission, some museums have been preoccupied with the objects in their collection, thereby disregarding the public's access to the objects. It was restricted since public access was considered a threat to preservation. In addition, museums have implemented a dynamic improper storage policy over the years. In addition, curators did not adhere to a valid storage policy. They had the propensity to acquire (*via* purchase or donation) new works simply because they had space in their reserves to store them. In addition, it was said that a museum that ceased adding to its collection was in decline. This conduct has delayed addressing the issue of lack of access until later. Nonetheless, it should be mentioned that an acquisitions policy without a storage collection policy could suffocate the museum to death. As time has progressed and the earliest museums have aged, the congestion of the invisible stored collections has led to a dynamically improper storage system. This policy has suffocated the storage space and rendered the collections inaccessible. The earlier method impacted storage and consequently became a widespread problem over time. Museums had to find solutions for their storage problems. The collections

must be administered so that preservation, collecting, accessibility, and all museum purposes do not conflict. This constitutes a challenging objective for collection management professionals. To reach this objective, the entire collection must be viewed as something to be relished by the audience, not as a burden.

Due to museums' social and cultural function, the stored collections have sparked public debate, and their monetary worth has been brought up. Museum professionals must deal with the increasing financial pressure, exacerbated by the fact that a significant portion of the collections are maintained with public funds. Museums should focus their efforts on finding solutions that consider the long-term cost of keeping objects, including those that are not actively used.

Museums are making attempts to incorporate diverse functions. The digitization of collections provides the opportunity to realize this objective so that collections can be preserved and utilized for future generations. This argument is significant for collections that contain vulnerable or light-sensitive items more susceptible to damage. For example, fragile ancient books require careful handling. They can only be viewed, and their pages are turned due to their digitization. The physical access would impact its ability to survive. Many items likely to be stored in a depot can be made accessible due to the digitization process. In addition, due to overcrowding, storage spaces are frequently hazardous for both collections and individuals. Due to a shortage of storage space, many items are stored in distant facilities. Consequently, the cached collections cannot be accessed. Similarly, cultural items on loan to other institutions are inaccessible to nontraveling individuals who reside in a different region.

The digitization of collections contributes to their democratization. The digital content makes collections available to anyone, including professionals. It contributes to the dissemination of culture and knowledge and inspires the creation of new content. It appears that this strategy to enhance collection accessibility enables individuals to appreciate collections. Regardless of where they reside, when they want to see them, their educational background, history, or physical conditions. Therefore, it is a tool accessible to everyone in the world. Modern technologies have increased the accessibility of collections and their associated data.

Digital content is a viable alternative to physical travel. For the above reasons, the digital content reaches visitors who could not visit the actual physical museum. Additionally, it makes collections accessible regardless of the user's location or ability level. Despite claims that physical visits are irreplaceable, digital content provides access to collections even when physical visits are not permitted. This excellent point has been validated since the first phase of the COVID-19 virus outbreak. Consequently, it contributes to expanding a virtual museum beyond the physical confines of conventional museums. The future challenge for museums that wish to preserve collections and make them more accessible for educational, recreational, and research purposes may be to balance digital and physical space to reap both benefits. In addition to researchers and academicians, casual visitors can access collections. It can reach an unlimited worldwide audience who can access the entire collection. Although cultural objects are irreplaceable, they serve museum missions according to the ICOM definition of a museum. In essence, it signifies that digitizing collections enables people to access collections even when they are not physically present.

Digital content embodies the significance of museum collections. Due to financial and time constraints imposed by the vast number of objects, digitizing the entire collection is impossible. Therefore, museums must implement criteria for selecting items to digitize. It implies that the significant components are typically objects of the procedure and are displayed. It could be argued that not all collections are currently

digitized and, therefore, accessible. Nonetheless, collection digitization is an ongoing process. Consequently, museums now provide more digital content, which is expected to increase over time. Additionally, it could be emphasized that the number of items accessible through digital content is irrelevant. In contrast, what is essential is that all collections are represented. This objective could be accomplished with a few items from the entire collection; therefore, the appropriate selection determines the degree of accessibility. For example, museums contain many items that are unlikely to be of interest to many people: repetitive items, for instance, can be reproduced from a small sample. Therefore, museum collections could be better represented by a small number of pieces that comprise the whole, as opposed to a large number of pieces of the same type. Occasionally, less is more, depending on the value of the less.

According to the previous considerations, digitizing collections is a satisfactory, albeit imperfect, solution for museums and individuals to preserve collections while making them accessible. It is said that museums store knowledge in the form of objects and that the physical experience cannot be replicated. In addition, the issue of inadequate space within depots due to overcrowding persists. Therefore, digitizing collections is likely to be viewed as a half-measure for the storage issue. The digital content, however, finds a balance between preservation and accessibility. Without digitization, stored collections would not be accessible at all, and they would remain unseen. Although this solution does not increase depot space or reduce the extent of stored collections, it improves their uses. Why are collections maintained if they are not utilized? Therefore, even in the half-measure assumption, it could be argued that a small outcome is preferable to none.

In conclusion, digital resources, including the museum industry, are expanding throughout society. The digitization process is essential for internal museum purposes and represents a crucial solution to the historical dilemma between the preservation and accessibility of museum collections. Thus, digitizing collections represents an excellent opportunity for museums and online users, as cyberspace is an infinite space that can potentially make unlimited collections accessible to anyone.

Conflict of interest

The authors declare no conflict of interest.

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Chapter 6

Users' ICT Skill

Azonobi Ishioma Nwanapayi

Abstract

The essence of this chapter was to acquaint users with the needed skills to navigate the various information resources in the library. The set goal was brought to bear on the distribution of questionnaires. In doing this, explorative approach was adopted. In academic libraries the existence of information and communication skills are not being felt as should be expected on the part of the users. Though information and communication technologies (ICTs) are well known and appreciated, but the skills are not easy to possess in defining problems, accessing, locating and evaluating information resources. Also revealed was the Big6 skills provided as each approach can be used whenever students are in a situation, academic or personal, which requires information to solve a problem, make a decision or complete a task.

Keywords: information and communication technology, skills, users, locating, libraries

1. Introduction

The evolution of world wide web (WWW) as a powerful tool in the field of education has restructured users' techniques and skills used in search of library resources to supplement coursework, seminar and research activities as it guarantees active participation in the teaching-learning process. According to World Book Encyclopedia [1], the proliferation of ICT products have changed the manner at which people live and have come to rely on it in almost all aspects of life, people rely on computers to handle a huge amount of information with incredible speed to solve life problem within a second. ICT is widely relied upon by all its users in virtually all facets of their everyday life. As noted by Lori et al. [2], user expectations regarding electronic access to information are increasing and university library collections are continually developing from primarily print-based collections to emergent electronic collections.

Universities, as the parent body of these libraries, try as much as possible to acquire and subscribe to these electronic information resources through their library databases to meet up with the insatiable needs of their students (users) as their quest for knowledge and information varies. Many universities in Nigeria, as stated by El-Maamiry [3] including those in the southern part, are investing in electronic information resources to increase access to their growing communities in various horizons. The library is providing thousands of scholarly journals through subscription to numbers of academic databases along with web-based resources.

Following the advent of the digital revolution, according to Jewell [4], libraries began incorporating information communications technological based products into their collection and services. The inclusion of these resources was driven by the core

value of Library science as expressed by a renowned Librarian, Dr. S.R. Ranganathan, in his five laws of library science; especially the opinion that electronic technologies made access to information more direct, convenient and timely which made users cling to these resources to unravel their greatest source of anxiety and uncertainty. Despite the usefulness of electronic information resources, according to Desta [5] and Togia and Tsigilis [6], users cannot make use of these resources due to lack of information and searching skills, knowledge and awareness of the available electronic information resources but rather preferred recommended books, reference books and journal articles as it saves time, cost and convenient to use.

Fatoki and Olayinka's study (as cited in [7]) posited that notwithstanding the significance of electronic information resources to university education, usage in Africa is still affected by quite a number of factors. Studies have revealed that these factors include poor funding of universities, high cost of Information technology equipment, high rate of foreign exchange, inadequate ICT skills and limited training on the effective use of electronic information resources.

2. Definition of information communication technology (ICT) skill

Information communications technology skill, as defined by *School of Oriental and African Studies (SOAS)* [8], encompasses techniques in knowing the different ways to find a piece of information, being able to locate and access the information whether in an electronic databases or in a journal and the ability to compare and evaluate the information obtained, organise, apply and communicate this information to others by proper citation of references and creating bibliography in an ethical manner. New kinds of competences, skills and confidence are required to respond to the need of the time that extends beyond the traditional library setting. Persons involved in research programme also are needed to intensively equip themselves with the mechanisms and techniques in accessing and retrieving desired information resources from the web-based information systems [9]. We live in an era of increased information flow and acceleration which required students to learn new skills and become more self-efficacious in the use of electronic information resources to manage perspective situations as it is the bedrock for human motivation necessary for personal accomplishment [10].

According to Hewitson [11], skills in using electronic information resources are related to individual factors such as information technology skill, subject and the extent to which users adhere to a professional development scheme. Nadzir [12] asserted that having ICT skills is relevant in students' course and with the emergence of recent information technology; access to information has been made much easier. ICT skill prepares students to meet up with the demand for the information age. This correlates Toyo [13] who emphasised that students require ICT skills to use electronic information resources.

Also, Kari [14] stated that ICT skill is necessary for students so as to equip them with the knowledge to cope with the information. He furthermore noted that students require adequate knowledge of information skills. Knowing when data is needed and being able to quickly locate, accurately evaluate, use, and clearly communicate information in a variety of formats are both examples of information skills. It refers to the capacity to manoeuvre through the rapidly expanding data environment, which includes a wide range of sources of information, including professional literature, popular media, libraries, the Internet, and much more. Since information is becoming

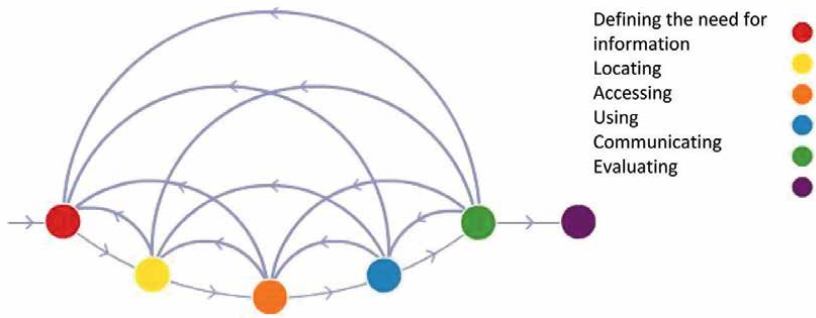
more widely available in unfiltered formats, its validity, reliability, and authenticity are all under scrutiny [15].

ICT skills are usually developed through information literacy. The Big6 skills [16] provided six (6) approaches of information skills such as; task definition, information seeking, accessing information resources, using information, synthesising and evaluation of information resources upon which individual can use library resources, each approach can be used whenever students are in a situation, academic or personal, which requires information to solve a problem, make a decision or complete a task. Due to the information explosion, it has become increasingly clear that students cannot learn everything they need to know in their field of study, within a few years, at school or the university.

Bruce's study (as cited in [17]) identified Information literacy to include an individual's capability to identify, locate and critically evaluate the information for decision-making, knowledge creation and problem-solving. Information literacy equips them with the critical skills necessary to become independent lifelong learner [18]. To become guaranteed learners, we need to know not just how to learn, but how to teach ourselves. We should acquire the abilities necessary to be freelance, independent learners.

An information literate person should be able to possess the necessary skills required to solve a problem at any point in time. The skills include; task (problem) definition, Information seeking strategies, locating and accessing information resources, Using information, synthesising and evaluation of information resources. Information skill, according to Kurbanoğlu [19] can be represented diagrammatically as thus.

ICT skills are the skills necessary to glean information effectively from sources. Many individuals develop these skills during their school years while others develop them during their world of work. With these skills developed, individuals are made capable of tackling the research-related challenges commonly associated with being a student or worker in an information-related field [20].



3. Users' skill in a task (problem) definition

This approach involves the information problem, identification of information needed in order to solve or complete a task as any information seeking, even the most basic, starts with research questions, the more complex the subject, the more it helps to clarify the main questions that need to be answered. A task may not be phrased as a question but still helps to work out the questions that need to be asked to complete the task [21]. It stated that for users to effectively use an information resource they

should be able to understand and abide by the acceptable use policies in relation to defining the problem they set out to solve. This requires critical thinking which most students do not realise, with this, they will be able to state and explain the goals and purposes, clarify the problems they need to solve, gather and organise information, express themselves precisely and exactly and distinguish significant matters from insignificant ones [22].

4. Information seeking strategies

This involves the ability to brainstorm all possible sources, selection of the best sources and thoughtfully reflect on the use of electronic information resources. Griffiths and Brophy [23] noted that Students are either unaware of alternatives to using search engines or have tried alternative methods but still chose Google (45% of respondents), a scenario that is now known as the "googling phenomenon." In addition, locating information is not always simple for students (even when using Google), and since a third of participants had trouble finding information, user awareness, training, and education must be enhanced.

5. Users' skill in locating and accessing information sources

After students should have determined their priorities for information seeking, they have to find information from a range of supply and access specific information from among individual source.

Users will be able to;

- Locate and use appropriate resources and technology available within the school library and local area network.
- Use electronic reference materials (e.g; electronic encyclopedia, dictionaries etc.)
- Conduct a self-initiated electronic survey through e-mail. Adetimirin [24] stated that postgraduates can locate and access their needed electronic information resources in the university libraries by providing access to electronic resources.

6. Users' skill in evaluating electronic information resources

This focuses on how well final products meet the original task (effectiveness) and the process of how well students carried out the information problem. It is the ability to judge the process (efficiency) and product (effectiveness). It is the skill required to critically evaluate information content and employ it effectively as well as an understanding of the technological infrastructure on which information transmission is based [25]. Users may evaluate their own work and process or be evaluated by others.

According to Nikolopoulou and Gialsamas [26], evaluating the quality of information retrieved is an important process of successful information searching when using electronic sources like the web is easily accessible. This skill is necessary as students are seduced to copy and paste without evaluation. In an environment where vital information repositories can be unreliable, and where information users are

progressively more social in their behaviour, a level of trust in an information source is critical to evaluation information resources [27].

Saleh [28] stated that it is necessary to evaluate information sources based on its originality, currency, and credibility and assess if the found information can be used for the learning task/project. University of Bath [1] noted that when an article is found in any academic journal, it is needful to consider whether or not it is of sufficient quality and relevance to use in your work. In doing this, the following advice should be considered:

i. Read the article abstract: this recapitulates the author's key findings and methodology. It helps in deciding whether the full article will need to be read.

ii. Note the year of publication: latest research might be needed. However, also check the end of a document for dates of the references.

Synthesise —This is the ability for a user to organise information from multiple sources and present the information.

7. Users' skill in using information

After finding probably helpful resources, students should interact in reading, viewing and listing the knowledge obtained to see its connection, so as to extract the relevant ones to resolve the known problem (information need) effectively, use the information to compose papers, complete dissertation and thesis or conduct work-related tasks. This information skill is the last in the process, as the usage of the information gathered is the ultimate goal of researching. This skill requires users to consider how all the information obtained will be covered and it involves the following stages according to Drew and Bingham [21];

i. Superficial stage—it involves looking at the title, table of contents, headings and overall image of the electronic information resources by skimming or scanning.

ii. Refined—reading through the first and last lines of a paragraph and introductory statement of the resource.

iii. Detailed/in-depth—it has to do with careful and thoughtful reading or observation to understand all aspects of the document.

iv. Understanding terminologies and the topic which helps to use general dictionaries.

v. Making sense of and analysing the information—this will help to ask some basic questions such as;

   a. What are the important keywords/points?

   b. Is there an issue which arises repeatedly?

   c. Are there any connections between aspects of the information? What are they?

   d. Is there a minority view?

e. Is the information accurate?

f. Is it up-to-date?

g. How does the information different from the sources compared?

h. Do they agree or contradict each other?

8. Conclusion

This chapter discussed the ability of users to recognise when information is required and possession of ICT skills to define a problem, searching, locating, and evaluating information and use of information resources effectively. In doing this, the academic librarians need to be very proactive in guiding users on how to acquire the basic skills.

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Chapter 7

Perceptions of Open Access and Digital Culture by Librarians in Academic Libraries in Israel

Liat Klain Gabbay

Abstract

Digital culture refers to the relationship between humans and technology, encompassing how individuals utilize technology, understand its significance in their lives, and adapt their activities accordingly. This culture manifests in various forms, one of which is through open access to scholarly publications. Over recent years, there have been significant shifts in the perception and engagement with open access among researchers, scholars, academic institutions, librarians, and leading publishers. This chapter aims to explore the intersection between the increasingly prevalent digital culture and the pervasive presence of digital technologies in nearly all aspects of modern life, culminating in what is known as digital culture. It uses the example of open access as a lens to examine one facet of activity within the realm of digital culture, investigating the evolving perceptions and practices surrounding open access scholarly publishing in recent years. A qualitative study was conducted among librarians working in humanities and social sciences academic libraries in Israel from 2017 to 2018 to understand these changes. The primary findings emphasize a positive evolution in the context of open access, illustrating how this shift is mirrored in the activities of academic libraries, as evidenced by the content published on their websites.

Keywords: digital culture, open access, institutional repositories, digitization, scholarly publishing

1. Introduction

Usually, digital culture is about organizations. Meaning, the way technology influences the organization regarding opportunities to connect people and partners, knowledge about technologies and enables creativity.

Similar to business organizations, the digital culture influences libraries and information centers as well. In these organizations, the technology and digitization have an important role.

This chapter discusses the mutual relations and influences of digital culture and open access to academic publishing. The chapter explains digital culture, digital libraries, open access, institutional repositories, and the way they make our culture digital. Then, the chapter exemplifies the perceptions of librarians who work on

academic libraries about these issues. The chapter gives the exact quotations of their answers and explanations about them.

The librarians' perceptions were examined by a qualitative survey that was conducted during the 2017–2018 academic year. The research consisted of in-depth, semi-structured interviews in order to examine how librarians in academic institutions in Israel perceive the idea of open access of academic publications and institutional repositories, and their awareness of the possibilities inherent therein.

The research population consisted of librarians working in the humanities and social sciences academic libraries. Interviewees were selected using both convenience sampling and snowball sampling. The sample included 15 librarians. The age range of the librarians was 25–60 years, and their seniority in the profession ranged from 3 to 35 years.

Furthermore, the chapter delves into the evolving and changing perception of open access and the role of academic libraries in addressing this issue. It explores how libraries engage in signing agreements with publishers and providing guidance to researchers on financial considerations related to publishing.

2. Literature review

Digital culture and open access would encompass the exploration of how digital technologies are reshaping cultural production, consumption, and distribution, as well as the ways in which content is made freely available online.

2.1 Digital culture

The digital technology influences a lot on humans' life. It simplifies the way to connect with people via variety of media communication, and in a private manner or in a group. In addition, it makes connection faster than on the past and continues to become faster and sophisticated all the time. These changes enable one to connect faster in a variety of ways, to study online courses, read books and articles, keep in touch with people, plan trips, book tickets, listen to music, use library catalogs, connect with scholars, and participate in conferences—which improve scholarly communication, and much more [1].

When speaking about the connection of technology and humans, it is important to realize that this connection and the influence of technology are driven by organizational culture that enables it. People are part of a certain system that enables to develop a culture that uses technology in many aspects of life [2, 3].

2.2 Digital culture in libraries

The culture is digital in schools, libraries of all kinds, and not just in business organizations. It seems that culture becomes digital. It is not just a manner of using technology and digitized materials, it becomes a culture that expect it, look for it, read, study, teach, and play with digital things.

Digital creates culture and influences culture in the twenty-first century and creates a completely different way of information seeking, social connectivity, expectations, and opportunities. It is very important for organizational innovation [4].

When we speak about digital libraries, we speak about an online library, a digital repository, or a digital collection. Digital objects can be objects that were created digitized or print files that were digitized. There are different kinds of digital libraries, different ways for retrieving information, different storage, and in general different scopes [5]. Digital library is a library where we can get access to electronic databases, digitized materials like articles, photographs, music, and movies, and each of them has a way to retrieve information, print, and save. We can find different types of digital libraries, just like in academic libraries, where there is an access to electronic databases by subscription or open access databases. Public libraries have access to digital books in different platforms. The issue of digital culture can be analyzed from different points of view and different categories. One of these categories is the open access to scholarly publishing.

2.3 Open access to scholarly publishing

The literature defines "open access" as "digital, online, free of charge, and free of most copyright and licensing restrictions" ([6], p. 4). Taubert and Weingart [7] explain:

Libraries traditionally provide access to research literature by acquiring, collecting, organizing, and indexing publications. They are the most important units on the demand side with respect to academic publications, and they acquire them through public funding. Libraries thus ensure continuous funding of the publishing companies and are a central element in the financing of the publication infrastructure ([7], pp. 6–7). Researchers forecast that open access publishing may become a central responsibility of academic libraries by the year 2034, sparing us from technological and financial constraints [8].

Open Access has had substantial impact on the role of libraries and librarians, shifting their focus away from being gatekeepers of information toward becoming active players who support the scientific and scholarly information being produced at their institutions and aiding its dissemination. It has been essential for them to acquire new skills and reinforce their abilities for these tasks while establishing publication and archival infrastructure and reallocating financial resources to providing access, rather than just paying for it [9].

The increasing adoption of an economic, profit-oriented model by large academic publishing houses and other changes in scientific publishing since the 1980s have led to an explosion of costs for libraries [10]. However, libraries' budgets did not grow, preventing them from absorbing the increase in price. Therefore, libraries were and are forced to restrict their activities in acquisition and collecting [6, 11].

It is important to note, however, that open access to research publications can also have some detrimental consequences for academic and research libraries because they create a situation in which financial control moves from the librarians to the researchers who are publishing or the institutions that fund them. This leads to a reduction in the library budget because libraries are no longer the only ones who receive funding for subscribing to databases and journals from the academic institution, there are others who control the budget and decide how to allocate it, without reference to the library. Thus, we have a situation in which, on the one hand, the academic libraries support the open access approach, promote it, and assist it, but, on the other hand, this activity saps at their power and hurts their budget.

The global Scholarly Publishing and Academic Resources Coalition (SPARC, see https://sparcopen.org/) promotes the open sharing of research reports and educational materials. The SPARC is driven by a commitment to democratizing knowledge by making it more accessible, and opening pathways to discovery with the goal of improving the return on investments made in scholarship. In its role as a catalyst, SPARC collaborates with all parties in the process: from authors and publishers to students, libraries, policymakers, funders, and even the public. Partnering with a global network of libraries and research institutions around the world, the coalition begins with the opportunities created by the Internet and promotes the infrastructure and cultural changes needed for open access to become the default mode for scholarship and education. Their strategy focuses on lowering the barriers that hamper accessing, sharing, and using knowledge [12].

Open access publishing is primarily an online method for disseminating research without any restrictions to access. Although most open access journals impose no restrictions on use, some do, such as permitting only noncommercial use. For that reason, open access publishers need a new business model because they receive no revenue from readers. Some publishers sell advertising in journals or find creative ways to offer pay-for-use services associated with their publications. Others generate revenue by charging authors for publication. Another option is to require payment for the most recent articles and release them for free public access only after a set period of time has passed (known as Delayed Open Access (OA) ([13], p. 362). Hinchliffe [14] exemplifies four categories of OA publishing models: transformative agreements; pure publish agreements; subscribe to open; and membership models.

Before setting policies for funders, planning infrastructure, or budgeting subscriptions, it is necessary to understand open access and its growth [15]. The concept of open access first developed among scientists and researchers in the exact sciences and natural sciences, and its status is stronger in those fields than it is in the humanities and social sciences [16]. It is not surprising, therefore, that open access publication is considerably more common in the life sciences and exact sciences [17]. Nevertheless, the social sciences and humanities have also experienced a significant increase in OA publications since 2006. Research has shown that 85% of researchers in these fields recognize the importance of open access publishing and would be willing to submit their articles to an institutional repository, if their institution was to request it [18, 19]. In 2013, scholars in the humanities established the Open Library of Humanities (OLH), an international project, to provide a way for researchers from these disciplines to publish peer-reviewed studies via OA. Enabling scholars to publish in this unfamiliar, innovative way contributes to collaboration between researchers. The founders of OLH were also attentive to the financial aspects of the project. By reaching financing and cooperation arrangements with major publishers, they were able to significantly reduce the prices that researchers had to pay for OA publishing [20].

Agreements: The importance of the transformative agreements, also known as "offsetting," "read and publish," or "publish and read" agreements, is that it has shifted the focus of scholarly journal licensing from cost containment toward open access publication. The "transformative agreement" is an umbrella term of different kinds of contracts. Transformative agreements are more transparent than traditional journal licenses, allow authors to retain copyright, and make provisions to facilitate the management of open access workflows [21].

In recent years, some of the well-known publishers (e.g., Elsevier, Wiley, IntechOpen) have also begun to publish scholarly journals using an OA approach. These journals are being developed in all fields. Rather than charging libraries a high

subscription fee for these journals, they estimate the cost of processing each article, until it is published online and included in the relevant repository or database and charge the author of the article or the sponsor of the research an amount sufficient to cover those costs [22]. "cOAlition S announced that after July 2022, only publishers who have provided data to explain their OA fees under one of two 'price and service transparency frameworks' will be eligible for their support, and that cOAlition S will support only OA publication fees that are 'fair and reasonable'" [23].

Between 2015 and 2019, Web of Science (WoS) indexed around 8,000,000 publications, whereas Dimensions indexed about 10,000,000 publications. Among these publications, 43% of WoS publications and 46% of Dimensions publications are open access (OA) publications, as illustrated in **Figure 1**. The key distinction lies in the distribution between the "green only" and "bronze" categories, with a higher percentage of OA publications in WoS falling under the former category and a greater percentage in Dimensions belonging to the latter ([24], p. 4).

When examining publications by region as illustrated in **Figure 2** in the two databases, we find that the proportion of open access (OA) publications is comparatively alike for North America, Europe, and Central Asia. On the contrary, for other regions, Dimensions exhibits a notably higher percentage of OA publications in comparison with WoS. This variance is particularly pronounced in South Asia (+57.9%), Latin America and the Caribbean (+36.6%), the Middle East and North Africa (+33.5%), and to a lesser degree, Sub-Saharan Africa (+12.4%) ([24], p. 5).

2.4 Institutional repositories

Green OA journals can be accessed through institutional repositories. A study published by Pinfield et al. [25] argued that these repositories are one of the most important developments that the twenty-first century has introduced into the world of research. A study examining the evolution of OA repositories from 2005 through 2012 shows that they began to emerge in the United States, England, Germany, and Australia, followed by Japan. In 2010, the trend began to appear in other east Asian countries, especially Taiwan, as well as in South America, especially Brazil, and in

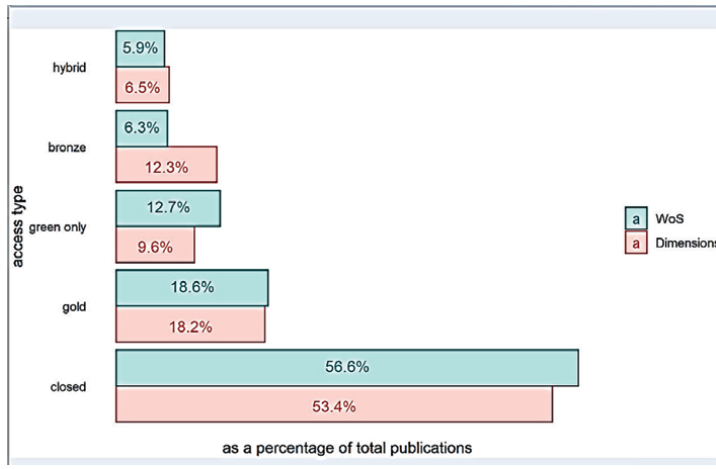

Figure 1.
Percentage of open access publications, by access type and database, 2015–2019 ([24], p. 4).

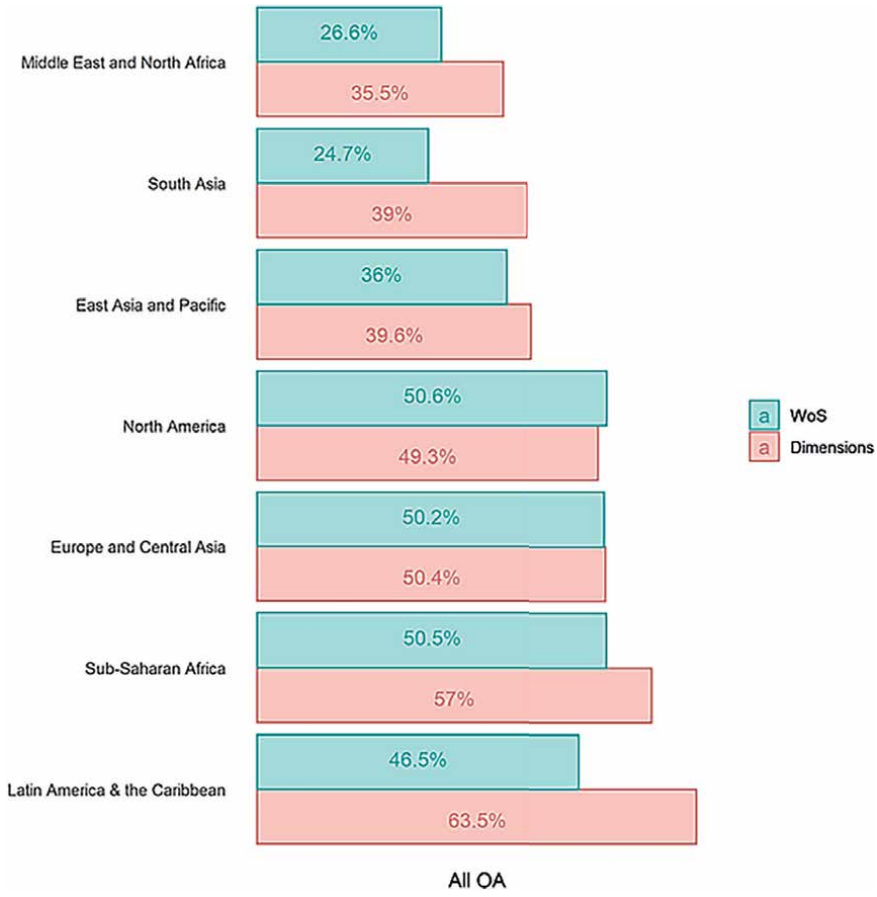

Figure 2.
Percentage of open access publications, by region and database, 2015–2019 ([24], p. 5).

Eastern Europe, especially Poland. Archives have also been developed in France, Italy, and Spain, but their penetration in China and Russia has come very slowly.

According to the Directory of Open Access Repositories (DOAR) compiled by the University of Nottingham, UK, as of May, 2023, there are 6027 repositories around the world, as illustrated in **Figure 3**.

DOAR's website gives us statistics about the number of repositories by country, by content types, and by content subjects software platforms [26]. Indeed, institutional repositories are gaining momentum at academic institutions around the world [27].

Open access is a platform for publishing research in journals with a different pricing method than the traditional method of journal publishing, which requires academic libraries to purchase subscriptions. Conversely, institutional repositories do not deal with publishing at all; rather, they preserve existing publications and make them accessible to the various users by centralizing the institution's research publications in a way that allows users easy access [28]. These two issues are important because as researchers collaborate and develop multidisciplinary fields of research, the amount of research communication between scholars—conducted through collaboration at conferences, in professional societies, and research groups—is growing as is the

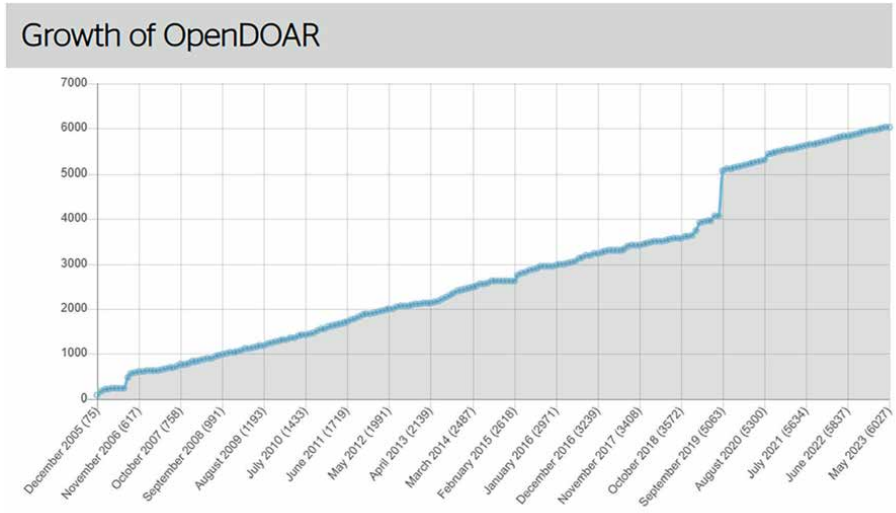

Figure 3.
Growth of OpenDOAR 2023.

quantity of papers published. The goal of OA is to change, at least in part, the current situation in which scholars who are seeking promotion must publish their research in journals produced by the major publishers who dominate the market, and academic libraries are required to pay increasingly large sums of money for subscriptions to databases and scientific journals operated by these publishers [28, 29].

3. Methodology

A qualitative survey was conducted in order to examine how librarians in academic institutions in Israel perceive the idea of open access of academic publications and institutional repositories and their awareness of the possibilities inherent therein.

3.1 Design and methods

During the 2017–2018 academic year, in-depth, semi-structured interviews were conducted with the librarians. The 20–30-minute interviews were held in a relaxed atmosphere, in the participants' workplaces. All interviews were recorded and transcribed. In the data analysis phase, the interview transcripts were sorted and categories constructed. The categories make it easier to interpret interviews' answers and exemplify them to the readers.

3.2 Research participants and sampling

The research population consisted of librarians working in the humanities and social sciences academic libraries. The research was qualitative and based on interviews and information from libraries' websites. Interviewees were selected using both convenience sampling and snowball sampling. The sample included 15 librarians. The age range of the librarians was 25–60 years, and their seniority in the profession ranged from 3 to 35 years.

3.3 Interview questions

The questions were as follows:

- What do they think about the issue of open access?
- If they think libraries are supposed to support open access?
- Do they think the researchers would cooperate with the libraries and what do they think researchers think about it?
- What are their opinions about institutional repositories? Academic libraries' role?
- What do they think are the attitudes of researchers about this subject?

4. Findings

The findings suggested that the attitude of Israeli librarians is similar to that of their peers in other countries. In other words, they understand the importance of OA and claim to support it, but in reality, they show reluctance marketing it to faculty members or do something to support it. Librarians realized that publishing in OA journals is difficult because of the high cost and such journals' allegedly lower quality. They know that some researchers are concerned about plagiarism; others fear that the university will not recognize the prestige and quality of the journals, such that publishing in OA journals will not necessarily be beneficial for advancing the researcher's rank.

4.1 OA and institutional repositories: librarians' perspective

From the librarians' responses, it is clear that they are aware of developments in the academic world and understand the importance of OA and its advantages when it comes to publishing research, alongside the importance they attribute to institutional repositories. In addition, they understand the indirect role that academic libraries play in promoting these developments. It was evident in the interviews that all of the librarians have positive attitudes toward both issues, but they admit that these approaches are not really developing in Israel, and there is little responsiveness in the field.

4.2 OA: attitudes of academic librarians

Librarians working in two different universities expressed very positive attitudes toward this issue and explained its importance well, even though they understand that most of the people involved do not see things as positively as they do. When they were asked to tell what they think about the issue of open access, if libraries were supposed to support it, do they think the researchers would cooperate with the libraries and what researchers think about it, they replied:

> *This is exactly the direction one should go, and the libraries must be there to support these moves. The agreements that exist today are very problematic and mainly, expensive. The quality journals cost a lot of money, and sometimes there's a situation*

> *in which a researcher at an institution publishes a journal article, and the university has no money to buy the journal (Interviewee no. 1).*

> *...the problem is that researchers do not perceive them good enough, quality enough to publish on them, pay for them and maybe at the end, they won't be good enough to promote them academically. (Interviewee no. 6).*

> *This is very important. It would be appropriate to have a lot of things open electronically, it could save time and open up research possibilities. Lecturers expect publications to be digital. If there were some sort of world catalog to which everyone would contribute, it would be useful for everyone it (Interviewee no. 9).*

> *The university pays researchers, and gives them research budget. Then it pays again when it purchases the journal in which the research is published; it pays twice and that makes it very hard on the budget, while the prestigious publishers earn a lot with no justification for it (Interviewee no. 15).*

4.3 Institutional repositories: attitudes of academic librarians

Several points were raised regarding the importance of institutional archives: they were asked about their opinions about institutional repositories, academic libraries' role, and attitudes of researchers about it:

> *Regarding the institutional repository, I see far beyond marketing needs. The libraries should participate in this, it contributes to the visibility of the institution (Interviewee no. 3).*

> *Establishing such a repository is a central activity for a library. The libraries should have been involved in the establishment of institutional repositories that bring together the research of an academic institution, so that searches will find articles coming from the institution (Interviewee no. 14).*

> *We do not have the resources to build such repositories. I think it's necessary to train people for these research consultant positions, information scientists who are involved in research, this could be a very interesting job in this era, for information scientists who are involved in content to make knowledge more accessible to researchers who would be more involved (Interviewee no. 10).*

> *I'm very much in favor. We have to make everything that can possibly be open in full text available, to make information accessible. We won't feel that we are losing our prestige as locators of information if we make it accessible to everyone; it's our job that changes. We can sort, organize, make everything as accessible as possible to users (Interviewee no. 7).*

> *Today, many good, peer-reviewed journals belong to publishers who make money from them. This is closed material that depends on subscribers, and it is out of our control. People should not think that if they have written something, they now need to protect it, rather it is important to understand that it must be made accessible to all. This is both convenient and provides exposure for the researcher and the university. There needs to be a systemic, conceptual change on the part of everyone, on the part of libraries, on the*

> *part of faculty and on the part of administration. The concept should be that just as we publish every event and conference, etc. on the university website, we must also publish all research with the university's name on it (Interviewee no. 11).*

The librarians' responses exemplify awareness of the importance to the issue and its advantages for academic libraries, researchers, the academic institution, and the scholarly publishing. But their responses exemplified the lack of cooperation from researchers' side and lack of awareness of its benefits and importance because they were not sure that publications of this kind will give them promotion.

5. Changes in academic libraries' activity in the issue of open access

Since 2020, there can be seen a very big change in the perception of the issue of open access in the academic world. Unlike in the past that academic libraries' websites did not give any information about open access and ways to publish in open access, for the last 3 years, a change can be seen. Academic libraries in Israel give a detailed information in their websites about open access, explaining how to publish in these journals, details about the article processing charge (APC), and the university involvement in the payment. It is an information and encouragement to use it that we could not see before.

There is a lot of information about publishers who have hybrid journals where scholars can publish in open access journals. These publishers are the well-known publishers who have a high standard of peer review process.

The same librarians who had participated in this research few years before spoke about the big change in this issue since 2020.

> *There is a change in perception, because in the not very far past, scholars hardly wanted to publish in open access journals because they though they are not qualified enough and therefore won't be good enough to give them promotion in their academic status. But from different reasons, we can see a positive change from the researchers, the university and the cooperation of the prestige academic publishers (Interviewee no. 6)*

> *... In addition, the publishing in these journals was very expensive, and they couldn't use their research budget from the university to pay for the very high costs of open access publishing (Interviewee no. 15)*

> *They afraid of plagiarism ... and did not cooperate with the library to promote it. In these days we can see a very big change. The researchers can receive help from the university to fund the publishing in open access. The universities acknowledge these journals quality enough for publishing and promotion. Therefore, academic libraries, the Israeli consortium, can sign contracts with publishers. This action enables researchers to pay for the publication in open access (Interviewee no. 1).*

> *The prestigious publishers, from their side, are doing their best in order to have a quality peer review and a plagiarism check (Interviewee no. 9).*

In the last few years, we can find all the information about it in the universities' websites because the universities have agreements with very important publishers and they even allocate budget for it.

How can it be? It seems that since COVID-19, the perception of open access has changed. During COVID-19, there were many restrictions, and therefore the universities allowed users to get access to scientific materials freely from home, at first about the disease and later about other scientific issues [30]. A research of Lee and Haupt [31] has shown that the extent to which a country was affected by COVID-19 had influenced international collaborations among researchers, open access scientific publishing about COVID-19, and later on other scientific subjects.

Before March 2020, academic librarians had already involved in online librarianship. Meaning, they purchased digital books, subscribed to online databases, and supported research with digital technologies. But since the lockdown of 2020, which forced to develop online courses in academic institutions, the librarians were challenged to help academic stuff move their courses online, work on new schedules, create online learning objects, and embed in online courses. The librarians gave support to the academic system in the period of COVID-19 and developed online services for their users, online interaction, and support for learning and leisure [32].

Then even when restrictions were canceled, the open access process has continued. In addition, the publishers realize that the cancelation of subscriptions will continue as the prices increase. Another reason is that researchers realize that open access journals are not necessarily not good enough and that they do have peer review [33]. Of course, not all of them, but the open access journals of the important and influential publishers are in good quality. Unlike in the past that a publication in an open access journal was not good enough to get a promotion, in these days, it is different, and these journals are considered as good as journals that have subscriptions. It is important to notice that most of the journals of these publishers are hybrid journals and not just e-journals. The influence and appearance in the research community are much higher than the open access journals [34, 35].

Therefore, we can see from 2020 that the Israeli Inter-University Center for Digital Information Services—MALMAD, whose role is to serve as a consortium for the acquisition, licensing, and operation of information services to universities and colleges in Israel, signed an agreement on behalf of the eight Israeli universities and forty colleges and research institutes to encourage researchers to publish open access and help them with the budget and even explain the advantages in this kind of publishing, things have changed completely from 2020 [36].

5.1 Few examples from Israeli universities' websites

Significant changes in the perception of open access publishing have been observed across various websites in recent years. These changes, occurring over a span of 3–4 years, highlight the growing importance, reliability, accessibility, and recognition of open access publications. Notably, shifts in perception and active involvement have been parallel among researchers, librarians, university administrators, and the recognition of the council for higher education in acknowledging the quality of such publications for researchers' promotion.

Libraries have been instrumental in this transformation, allocating financial resources supported by universities to establish collaborations with reputable publishers. Librarians play a crucial role in facilitating accessibility and guiding researchers on the diverse publication options available. As part of their services, library websites feature lists of publishers, discounts, precautions against predatory journals, information on open access conferences, and more.

> *"Discounts for Open Access Publications The Libraries and Information System is Working for You.*
>
> *The costs of publishing in open-access journals can be high for researchers. Therefore, the Libraries and Information System continues to make efforts to sign agreements that can enable Bar Ilan researchers to publish their works at reduced costs or no cost at all ... .The Libraries and Information Division has signed agreements with the following publishers ... Tools and Tips for Publishing Open Access Articles ..."*

Bar-Ilan University https://lib.biu.ac.il/en/node/1802.

> *"What is Open Access (OA)?*
>
> *Up until recently scientists and researchers published their scientific work in journals which allowed only paying subscribers to access their contents, in print or online.*
>
> *New thoughts about the origin of the money invested in research and who gets the right to read it when published, led to the concept of Open Access and to the principle that the world's knowledge is more powerful when it is shared.*
>
> *Open Access means that research outputs are distributed online, free of charge, or other access barriers. The reader is not required to pay in order to read the journal's content. He can read, download, copy, distribute and print as long as he acknowledges the authors and cites the paper properly.*
>
> *The library sees great importance in promoting publishing of research in the open access model".*
>
> *Tel Aviv University Libraries have signed agreements with leading publishers, which allow TAU researchers to publish open-access articles free of charge or with a significant discount.*
>
> *A list of publishers and journals are included in the Open Access agreements. A guide how to apply....*

Tel-Aviv University Libraries—https://en-libraries.tau.ac.il/Open-Access-Libraries

> *"Open Access Publishing*
>
> *The following is a list of publishers who grant Open Access publishing discounts to Haifa University faculty."*

Haifa University https://lib.haifa.ac.il/index.php/en/research-teaching-eng/research-teaching-eng-1/open-access-eng

> *"The library has new contracts for the year 2022 with publishers, for publishing articles in Open Access with no APC (article processing charge) to BGU faculty (or with a discount).*

> *Publishing in Open Access can increase the readership and visibility of your research and help to find more potential collaborations and recognition.*"
>
> Ben Gurion University https://libguides.bgu.ac.il/guides/open_access

6. Discussion

The discussion in the text centers on the mutual relationship between open access and digital culture. It highlights how open access to scholarly publications compared to subscription access influences information-seeking behavior and expectations for information retrieval. The text emphasizes that open access plays a significant role in shaping the development of digital libraries and digital culture, representing a substantial change in scholarly publishing, academic research, and access to information for researchers and academic libraries. It also mentions that greater awareness of open access within the academic community has promoted the development of digital culture, underlining it as a crucial issue within academia.

On the other hand, digital culture influences open access. Meaning, that in these days, all of us know that we can find almost everything digitally and therefore expect it and promote digital systems. We use many digital systems in many different areas in our life, and it seems that our culture is digital in so many ways. Therefore, there is a mutual fruition between open access which is digital and between the digital world/culture that promote the issue of open access.

Libraries are part of the process of making information accessible to researchers. The libraries are integrating into the practical aspect of open access: they upload publications, theses, dissertations, offer links to search engines and websites, as well as referrals to various journals and tools for free, open use through the library's website. They are seen as natural allies of faculty members because they pay for digital subscriptions and pay for library technologies which enable one to access the information. Over the past few decades, libraries have had to cut back on the number of journals they purchase, as a result of rising prices. This impairs the accessibility of information to their researchers. Therefore, it seems that they should encourage an open access approach to information.

Studies [37–39] show that, in general, researchers still have inaccurate, negative conceptions about OA journals. Although many do recognize the importance of OA, they prefer not to publish in them because of the reality of academic advancement. Therefore, it is important that librarians in academic libraries adopt a more active approach and inform researchers about OA publishing options, especially the quality journals, their rankings, the copyrights for these publications, and their contribution to scholarly communication. Clearly, this should be done with recognition of the relevant research fields for the institution, and awareness of the existing organizational culture, especially how the administration perceives this type of publication and the idea of information sharing. Librarians have the strength to change researchers' negative position in an era when also large and prestigious publishers, who dominate the academic publications market, are publishing OA journals.

Since the 1990s when these ideas were first discussed, they have made significant progress internationally, although there are considerable differences between countries and disciplines. Librarians know that the problem is that faculty members in Israel knew that academic institutions did not recognize research published in OA

journals when considering them for promotion and tenure. As a result, they preferred the prestige of the traditional journals, primarily in English [40]. In addition, they knew that OA e-journals required high fees from researchers who want to publish in them, and most of them were not able to pay these amounts, especially because universities did not allocate funds for this purpose. Another argument raised by the interviewees was the fear that researchers feel of losing their copyright for the intellectual content of their publications.

Regarding institutional repositories, a study published by Pinfield [24] argued that these archives are one of the most important developments in the research world in the twenty-first century. However, another study [41] revealed that while institutional repositories are a good channel for publishing articles via the green OA approach, only a small proportion of articles are published this way. Thus, academic libraries do have a role to play in advancing institutional repositories. Some faculty members spoke about the need for libraries to change their traditional role and how they provide services so as to cater for the increasing availability of open educational resources and other OA content. As Liauw (2011, as cited in [42], p. 47) notes:

Creating open access repositories platforms is one good effort, but academic libraries must go beyond their roles of just populating their repositories' content. Collaborative effort with various communities within and outside the institution will strengthen libraries roles' and help to increase institutional visibility.

Based on the responses of Israeli librarians, it seems that they are aware of the developments in the academic world and understand the importance of open access and its advantages for research publications, as well as the importance of institutional repositories. In addition, they understand that academic libraries can indirectly contribute to advancing these developments. However, they admit that these measures are not adequately developed in Israel, and there is insufficient responsiveness. In general, librarians are more supportive of an open approach than faculty members, perhaps because they see the issue from their professional perspective and consider the potential for the library to integrate into these processes. Moreover, librarians understand that libraries will benefit indirectly from the adoption of OA. Currently, the publishers of the databases and journals are very influential in the market and have almost no competition.

However, if there were more OA journals, then that would create competition and publishers would be forced to lower prices. Reduced prices would, in turn, help libraries to acquire more journals at more reasonable rates, and they would not need to unsubscribe from expensive publishers, as most libraries have now done. Continuing those subscriptions would lessen faculty members' disappointment with the library's resources and its ability to meet their needs.

In the last 3 years, it seems that the academic libraries have become more active in the open access process and signed on agreements with the prestigious publishers to promote this issue. They give a detailed information about how to publish in these journals and different payment arrangements that can be supported by the academic institution. It seems that we continue to see the influence of COVID-19 on open access, but it is much more than just this reason. The world of publishing has changed, the way of payment for publications has changed, the universities allocate budget to the library for open access agreements; otherwise, all these cannot be carried out. It seems that the heads of academic institutions recognize the importance, quality, and changes in academic publishing and allocate budget for it.

7. Conclusion

It seems that the greater awareness to open access in the academic world from the scholars' side, academic librarians' side, and academic publishers has promoted and influenced the development of digital culture. As it was written before, there are many issues influencing the development of digital culture, but concerning the academic world, this is one of the most important issues. As academic libraries increasingly engage in open access agreements and initiatives, the landscape of scholarly publishing is evolving, driven not only by the necessity of digital access but also by broader changes in academic culture and budget allocations. The ongoing influence of factors such as the COVID-19 pandemic further underscores the importance of open access in scholarly communication. By embracing open access and fostering a culture of information sharing, academic institutions can navigate the evolving publishing environment, promote broader access to research, and support the scholarly community's diverse needs.

The conclusion drawn from the text is that there exists a symbiotic relationship between open access and digital culture. It points out that while digital culture influences open access by promoting digital systems and expectations for digital content, open access, in turn, impacts the digital world by fostering the availability of digital information. The text also stresses the role of libraries in the open access process, emphasizing the need for libraries to encourage an open access approach to information and support researchers in understanding the benefits and options of open access publishing. It further discusses the progress made in advancing open access internationally and the evolving role of academic libraries in facilitating institutional repositories and promoting open educational resources. Lastly, it suggests that increased support for open access initiatives, including more OA journals, has the potential to reduce costs, enhance access to publications, and benefit both libraries and faculty members.

Conflict of interest

The authors declare no conflict of interest.

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Chapter 8

Prospects of Digitalization Practices in Academic Libraries in Delta State, Nigeria

Eniekebi Ejiroghene Regina

Abstract

This work is a continuation of work done in Edo State, which aims at strengthening digitalization practices in academic libraries. The research looked into digitalization techniques in academic libraries in Delta State, and descriptive research design was used for the investigation. The population consists of academic library workers. Simple random technique was utilized to choose four schools in Delta State, with 40 library employees serving as the study's sample. Self-created questionnaire was used. It was created in a closed-ended format of Yes or No. The instrument's dependability was determined utilizing Cronbach's Alpha. The data was evaluated using simple percentage statistical technique. The findings demonstrated that academic libraries' digitization practices boosted access to library items, effective preservation of library materials, improved library service, quick retrieval of documents, and improved library exposure. Despite the benefits, librarians in academic libraries confront hurdles in developing successful digitization practices. Alternate power supplies, such as high-capacity generators and usage of solar electricity, are required to address the country's unpredictable power supply. Furthermore, libraries should seek out professors on their campuses who are developing or utilizing novel technologies such as those outlined in this write-up and begin employing them, to test them in collaboration with other instructors and students.

Keywords: prospects, digitalization, practices, libraries, procurement

1. Introduction

The information professional of the twenty-first century must be skilled in selection, content management, knowledge management, information organization, research services, establishing and maintaining digital libraries, and bringing information resources to the desktop. People with the necessary skills are essential to the success and competitiveness of today's information ecosystems [1]. Librarian employment have gotten more competitive with similar occupations such as information technology. To be competent in a digital culture, library workers must acquire the necessary skills and competence. Academic libraries have been impacted by advances in information and communication technology (ICT) and its application to libraries

in recent years. Its first appearance has transformed not only how information is packed, processed, saved, retrieved, and disseminated in the twenty-first century, but also how consumers seek and access information.

The term "digitization" is defined variously by different researchers. Witten adn Bridge [2], digitalization is described as the process of transforming traditional library items such as books and papers into electronic form so that they may be stored and handled by a computer. Gbaje [3], digitization refers to the process of transforming non-digital born documents into digital format. Thus, digitization encompasses the entire process of turning traditional information assets into machine-readable format (digital format). Digitization entails more than just converting paper documents to digital versions; it also encompasses policy formulation, planning, and implementation. Budgeting, acquiring appropriate technology, scanning, uploading to the web or repository, preserving, and maintaining archival media, and organizing digital content into a navigable format (flexible and compatible programs) for increased access and effective service delivery of digital content to the target audience.

The education or academic library serves as a focal point for serious and focused intellectual development and scholarship. It is an essential component of the intellectual, cultural, and socioeconomic symbolic and mutually advantageous interaction that exists between the academic library and the academic community. The academic library is vital because it serves best when it is adequately stocked to act as a repository of information to which users can turn for help. Data or information. In this vital capacity, [4] asserted that academic libraries have played critical and important roles in promoting research in all subjects and disciplines inside their host institutions and colleges for millennia. Aina [5] stated that the major goal of an academic library is to support the objectives of an academic environment in the areas of learning, teaching, research, and services in his thoughts on the value of the academic library.

The practice of digitization in academic libraries has numerous invaluable benefits, including increased visibility of the library's resources, improved service delivery to a wide range of users, and improved access to current and vast amounts of information from remote sites/locations, as users can easily access library resources from anywhere. It ensures better preservation of library resources by reducing handling of original print materials and alleviating problems normally associated with conventional library environments such as mutilation of information resources, theft, space constraints, scarcity or limited number of copies, limited hours of operation, and poor storage environment normally associated with traditional library environments. It is a veritable e-learning information source, as well as a platform for global library collaboration and interoperability.

One of the main features of current global information trends is digitization, which fits into library and information service for effective and efficient information transmission, preservation of information resources, and simplifying the integration of library and information services. Services into the learning process of academic institution. Libraries can now deliver information sources online with intrinsic values thanks to digitization. Digitization makes library resources more accessible. By digitizing library collections, information will be available to everyone rather than just a small group of researchers. Users can search for collections quickly and thoroughly using digital projects from anywhere at any time. The unseen becomes visible as a result of digitalization. Multiple people can access the same information at the same time without difficulty. It also eliminates distance issues, as users no longer need to travel to libraries that have hard copies of library resources before they can access and utilize them [6].

Digitization has the potential to turn Africa into a global producer of indigenous information and knowledge. Rather than being passive consumers of imported knowledge, this contributes to the preservation of our cultural legacy. As a result, digitization enables the globalization of local content and the local accessibility of global information resources (GIR). Most digital projects in Africa are collaborative. The Digital Image endeavor of South Africa (DISA), for example, is a collaborative endeavor of South African librarians, archivists, and scholars. Another example is Kwetu Net, which has partnered with African governments and universities to create a full-test database on East Africa. Krubu and Osawaru [7] stated that, since its inception, various digital library initiatives have been developed, including those of the Association of African Universities (AAU), Rhodes University in South Africa, the University of Nigeria Nsukka, and the Africa Digital Library (ADL). of Africa's digital library programs. In Nigeria, significant attempts have been undertaken to digitize library collections throughout the country.

In the face of increasing digital technology, academic libraries are battling to maintain their position as important sources of inquiry. Library users (particularly digital natives) have more expectations than ever before of librarians and information workers in order to access the relevant information and expertise in the right format and at the right time from wherever they are [8]. The invaluable relevance of library digitization includes improved access to library contents, the ability for multiple users to access the same information materials at the same time without interference, the elimination of the problem of distance, and the improvement of library facilities. This has become one of the primary impetuses for change in academic libraries in the digital age for the adoption of ICT and digitalization library resources. Despite an extraordinary attempt by Nigerian university libraries to digitize their native materials across the country, progress has been glacial. Scholars have highlighted, however, that assuming that the introduction of computer-based libraries (digital library systems) gives ideal and trouble-free information management options is always deceptive. These apparent issues could be due to a variety of difficulties. Understanding these problems is critical for any university that is digitizing its resources. There is clearly still a gap that has to be filled. be filled in order to implement effective digitalization activities in the country's academic libraries. As a result, this study aims to investigate the potential of digitization methods in Nigerian college libraries.

2. Purpose of the study

The primary goal of this article is to investigate the future of digitization methods in academic libraries in Delta State, Nigeria. The specific goals of this research are as follows:

1. Investigate the future of digitization methods in academic libraries in Delta State.

2. Determine whether or not academic libraries in Delta State have digitizing facilities and equipment.

3. Investigate the issues impacting the digitization of library resources in Delta State academic libraries.

3. Question for research

1. What are the prospects for digitalization procedures in academic libraries in Delta State?

2. Is there digitalization equipment and facilities in academic libraries in Delta State?

3. What are the obstacles to digitizing library resources in Delta State academic libraries?

4. Digitization purpose in libraries

Digitization, as one of the most important aspects of current global information trends, fits into library and information service for effective and efficient information dissemination, preservation of information resources, and facilitating the integration of library services into academic institution learning processes. Libraries can now deliver information sources online with intrinsic values thanks to digitization. Digitization makes library resources more accessible. By digitizing library collections, information will be available to everyone rather than just a small group of researchers. Users can use digital projects to search for collections quickly and thoroughly. Whenever and whenever you want. The unseen becomes visible as a result of digitalization. Multiple people can access the same information at the same time without difficulty. It also eliminates distance issues, as users no longer need to travel to libraries that have hard copies of library resources before they can access and utilize them [6].

Pandey and Mishra [9] stated in their work that "academic libraries are digitizing materials because they are aware of the ongoing valve of library resources for learning, teaching, research, scholarship, documentation, and public accountability." "Another reason for digitization is to make access facilities to these resources: to preserve the age-old materials for long use, which are important and valuable for the future, to facilitate new forms of access and use," they added. Improved and expanded access to a defined stock of research resources; establishment of a single point of access to documentation from several institutions on a specific issue; support for democratic consideration through increased accessibility to public records improved search and retrieval capabilities for library-type items, to provide possibilities for the institution to grow its technical infrastructure and staff skill capacity. UNESCO [10] mentioned in one of her publications titled "the guidelines for digitization project" that the reasons for undertaking a digitization project vary and may overlap. These are some of the reasons:

- Increase access: This is the most obvious and fundamental reason when there is a strong demand from users and the library or archive wishes to improve access. to a certain collection;

- Improve services to a growing user base by increasing access to the institution's educational and lifelong learning resources.

- Reduce the handling and usage of fragile or heavily used original materials, and make a "back-up" for an endangered material, such as brittle books or documents.

- Provide possibilities for the institution's technical infrastructure and employee skill capabilities to grow.

- Develop a collaborative cooperation with other universities to develop a virtual collection and expand global access.

- Seek collaboration with other institutions to capitalize on the economic benefits of a collaborative strategy.

As a result, digitization has the advantage of presenting library collections electronically, hence enhancing access to library resources, allowing for faster collection searches, and removing distance issues. Space constraints and the cost of print collection (maintenance and restoration of traditional library materials) are alienating. It raises the profile of an institution by showcasing digital collections, which can be a useful public relations exercise. It creates visibility not only of the library's content, but also of scholarly work (theses, dissertations, project work, seminar papers, conferences proceedings, working papers, and technical reports) within the university [11].

5. Resources available for digitalization

Most libraries, and especially academics, are working to digitize cultural and intellectually valuable information materials. Fatoki [12] contend that selecting items for digitization requires considerable effort and involves a number of essential elements that must be thoroughly considered prior to embracing digitization. Musa and Musa [13] discovered in their research that the Theses, dissertations, seminar papers, conference proceedings, and reports are among the information resources accessible for digitization at Kashim Ibrahim Library. They also claimed that other types of information resources, such as books, reference materials, and scholarly journals, may not be digitized due to copyright difficulties. Jagoboro [14] reported that the information materials being digitized at Hezekiah Oluwasanmi Library, Obafemi Awolowo University (OAU) Ife are newspaper collections, as well as the abstracts of Master and Doctoral theses and dissertations. Similarly, [15] reported that PhD theses, master's theses, and dissertations, Bachelor's degree projects, inaugural lectures, University newsletter, lecturers' scholarly articles/publications, textbooks, term papers, and many other university materials were among the materials for digitization.

6. Difficulties affecting the analysis of academic library resources

The introduction of digital technology and the digitalization of library resources presents numerous obstacles to the primary stakeholders, which include library administration, personnel, and library users. Digitization has presented significant hurdles to librarians and other information managers in underdeveloped countries. Baro et al. [16] contend that one of the primary challenges confronting digital library projects in Africa has been academic libraries' willingness to implement digital library services in terms of skills and knowledge. Usman and Lyin [17] listed some of these issues as follows: insufficient funding, insufficient digitizing equipment, insufficient knowledge and skills, insufficient institutional policies, and insufficient power assistance. On the same note, [18] recognized other hurdles to African digital

library development, such as significant funding limits. Insufficient infrastructure (e.g., electricity, telephone line, building, etc.), outdated staff training opportunities and facilities, harsh environmental conditions, accelerated equipment degradation, insufficient salaries and difficult working conditions, and insufficient skills in strategic planning and grant proposal for Digital Library Projects. Akintunde [19] underlined the importance of "clearly establishing and recognizing ownership rights in all digitization projects." [20] emphasized that another concerning feature of legal significance is that the copyright may be granted." On that point, the University of Jos recently formed a committee to examine who owns the rights to theses and dissertations (the student or the university) [9], on the other hand, said that "the copyright of theses, dissertations, academic reports, and other internally generated documents belongs to the institution and (as such) no permission is required. " to make them digital."

7. Methodology

A descriptive research design was used for the investigation. The population consists of all library workers from Delta State's academic libraries. A simple random selection technique was utilized to choose four (4) schools in Delta State, with forty (40) library employees serving as the study's sample. As a data collection instrument, a self-created questionnaire was used. It was created in a closed-ended format of Yes or No. Experts moderated the instrument and confirmed its validity. Cronbach Alpha was used to determine the instrument's reliability. The data was evaluated using a simple percentage statistical technique.

8. Results

See (**Table 1**)

In the table above 36 (90%) respondents say Digitalization improves library visibility while 4 (10%) Say No to it. The practice of digitization improves the

S/N	Items	Yes		No		Total	
		Freq	%	Freq	%	Freq	%
1.	Digitalization practice improve library visibility	36	90%	04	10%	40	100%
2.	Digitalization practice enhances effectiveness of bibliographic control	32	80%	08	20%	40	100%
3.	Digitalization practice help librarian to effectively reserve library materials.	34	85%	6	15%	40	100%
4.	Digitalization practice increase librarian access of library materials	32	80%	8	20%	40	100%
5.	Digitalization practice improved library services	40	100	—	—	40	100%
	Total	174	87%	26	13%	40	100%

Table 1.
Question 1: What are the prospects for digitalization procedures in academic libraries in Delta State?

S/N	Items	Yes		No		Total	
		Freq	%	Freq	%	Freq	%
1.	Projects & academic staff Publications	40	100%	—	—	40	100%
2.	Newspapers	35	87.5%	05	12.5%	40	100%
3.	Catalog cards	34	85%	6	15%	40	100%
4.	Indexes	33	82.5%	7	17.5%	40	100%
5.	Books & Archival materials	40	100	—	—	40	100%
	Total	182	91%	18	09%	40	100%

Table 2.
Is there digitalization equipment and facilities in academic libraries in Delta state?

effectiveness of bibliographic control according to 32 (80%) respondents, as against 8 (20%). The process of digitization assists librarians in properly reserving library materials because 34 (85%) responded to it while 6 (15%) is against it. Increase librarian access to library materials through digitalization 32 (80%) while 8 (20%) says No. The practice of digitization improves library services is proved by the response 40 (100%). As a result of the cumulative value of Yes (87%) is bigger than No (13%), it indicates the prospects of digitization procedures in Delta State academic libraries.

According to **Table 2**, all of the respondents agreed to choose 'Yes' for item 1 (100%), while none of the respondents chose 'No'. For item 2, the majority of respondents 35 (87.5%) chose "Yes," while the remaining 5 (12.5%) chose "No." The majority of respondents 34 (85%) answered 'Yes' on item 3, while the remaining 6 (15%) chose 'No'. For item 4, the majority of respondents 33 (82.5%) chose "Yes," while the remaining 7 (17.5%) chose "No." Finally, 100% of respondents chose 'Yes' for question 5. As a result, because the cumulative value of Yes (91%) is bigger than No (9%), it indicates that there are equipment and facilities to be digitalized in Delta State academic libraries (**Table 3**).

According to the poll, the majority of respondents (87.5%) answered 'Yes' for item 1, while the remaining 12.5% chose 'No'. For item 2, the majority of respondents (80%) picked "Yes," while the remaining 20% chose "No." 31 respondents (77.5%) opted for 'Yes' on item 3, while the remaining 22.5% opted for 'No'. Furthermore, 90% of respondents answered 'Yes' while the remaining 10% chose 'No' for item 4.

SIN	Items	Yes		No		Total	
		Freq	%	Freq	%	Freq	%
1.	Lack of planning digitization.	35	87.5%	5	12.5%	40	100%
2.	Inadequate funding	32	80%	8	20%	40	100%
3.	Inadequate skilled personnel	31	77.5%	9	22.5%	40	100%
4.	Inadequate computer technology	36	90%	4	10%	40	100%
5.	High cost of purchasing equipment	32	80%	8	20%	40	100%
	Total	166	83%	34	17%	40	100%

Table 3.
What are the obstacles to digitizing library resources in Delta state academic libraries?

For item 5, 32 of the respondents (80%) picked "Yes," while the remaining 20% chose "No." Since then, the cumulative value of YES (83%) responses has been higher than NO (17%) responses. It therefore demonstrates the issues or problems affecting the digitization of library resources in Delta State academic libraries.

9. Discussion of results

According to the data, study question 1 demonstrated that digitalization practice improves library visibility and bibliographic control effectiveness. It also aids librarians in the optimal preservation of library materials. Digitalization improves librarian access to library materials and services. These findings support the preceding observation. According to [9], the motives for digitization are "to improve access to these resources (information materials), to preserve age-old materials for long use, and to provide better search and retrieval facilities for library-type materials."

According to the research, the information materials to be digitized in libraries include projects, indexes, books, academic staff publications, archive materials, catalog cards, and newspapers. This finding is consistent with that of [13], who found that the information resources available for digitization in Kashim Ibrahim library are theses, dissertations, seminar papers, conference proceedings, and reports in their study. Similarly, [15] stated that inaugural lectures, books, scholarly articles by lecturers, university periodicals, and a variety of other university items were included. in the digitizing materials at the University of Nigeria Nsukka (UNN).

According to the findings, research question 3 revealed a lack of planning digitization, insufficient funds, insufficient experienced employees, insufficient computer technology, a high cost of purchasing equipment, and so on. The findings are consistent with a report by [17] on the obstacles of digitization in libraries, which stated that "inadequate funds, lack of digitization equipment, inadequate knowledge and skills, lack of institutional policy, and lack of electricity support" This demonstrates the importance of a serious and concerted effort to address these issues.

10. Conclusion

Digitization of library resources has been identified as a critical development aspect in today's libraries, particularly in academic settings. This current trend has continuing to change the pattern and scope of library services. Digitization is a significant component for academic libraries in the twenty-first century because it allows for new ways to search and access library contents regardless of place or time. It was also discovered that academic libraries' digitization practices improved access to library materials, effective preservation of library materials, library service rapid retrieval of documents, and library visibility. Despite all of the benefits of digitizing library resources, there are still many problems in librarians' efficient digitization practices in Nigerian university libraries.

11. Recommendations

According to the study's findings, it is suggested that;

Libraries should look for lecturers on their campuses who are creating or utilizing novel tools like those outlined in this article. up and starts experimenting with them in collaboration with other lecturers and students. Librarians must motivate their users through content (learning) or other means, such as student development of applications that make academic library information and services more relevant to certain groups of users.

In order to address the country's irregular power supply, alternative power sources such as high-capacity generators and the use of solar electricity must be given.

The library should create a copyright mechanism that allows them to deliver information without breaking copyright law, known as copyright management, by prohibiting users from reproducing intellectual content from the web.

Academic libraries should investigate the possibilities of offering mobile library services while collaborating with mobile phone providers. Enhanced sending frequency to avoid network failure at decreased tariff.

Academic libraries should seek additional financial assistance from donor organizations such as the MacArthur Foundation and the Carnegie Foundation for digitization projects.

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In today's digital era, the emergence of digital libraries, collections, and repositories stands as a significant advancement. Across various organizations, there's a notable shift toward digitization driven by both technological advancements and the proliferation of vast amounts of data, texts, artworks, and other collections. With information volumes reaching unprecedented levels, the imperative to organize it in digital formats becomes apparent. This digital transformation has given rise to a pervasive digital culture, particularly evident in academic libraries, museums, and nonprofit organizations. This culture profoundly influences how information is accessed, utilized, and organized. The book addresses key aspects of this digital paradigm, including digitization processes, open access principles, and the protocols and standards governing the utilization of digital information. It examines the broader landscape of digital libraries, repositories, and collections found in galleries and museums. Moreover, the book explores the evolving skill sets required by users in adapting to these digital advancements, as well as the standards necessary for implementing digital organizational structures. By taking a comprehensive view, it highlights both the advantages and challenges posed by these digital developments, offering insights into their multifaceted impacts on contemporary society.

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