
Importance of Library and Information Communication Technology Standards in the Digital Era: An Analytical Study

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Abstract: The information standards and specifications are very important for providing better services to the end-users. In this case, almost all the levels of library activities the standards and specifications should maintain. The network-based library automation is the main task to maintain, the overall work process within the library and information centers. In this article, the author focuses on the specific library standards used for operating the network-based library automation-related process. There are many standards and specifications are available for library and information systems, resources, services, and other areas. This paper highlights the important areas of ICT based LIS standards like bibliographical data, metadata, information processing, and retrievals, networking, digital library, internet, and Web, etc. This study focuses on the Information and Communication based Library and Information Science international standards used by the library professionals to organize, processes, maintain, operate, and disseminate the quality of products and service to the end users. With standards and specifications Library and Information Science professionals can easily maintain the overall processes and functions of a library work without more effort. This article focus only few standards and specification but there are many number of technical and performance standards not covered in this article.

Keywords: LIS Standards, International Standards Organisation, Library Automation, Library Networking, Digital Library, Standards, Specifications

1. Introduction

Managing information has become challenging for many organizations without using standard tools and software. All library automation and networking today that has assumed the highest priority is the use of international standards and specifications. After deciding on moving towards traditional processes to networking and automation system we must be very careful while finalizing the standard software and other tools. Library automation and networking are all about connecting to other libraries and information centers, to share, retrieve, peer groups, databases, resources, etc. The Library and Information Science related specific standards are also essential for providing better services to the library users. Main aim of this article is to identify some specific Library and Information Science standards used in identified areas like bibliographical data, metadata, information processing

and retrievals, networking, digital library, internet, and Web, etc [25, 27].

2. Previous Studies

This paper focuses on the important standards and specifications available in the library and information science as well as ICT, related areas like networking, Internet, web technology, etc. Many studies have shown, but in this article few studies are taken for the standards of library automation and networking.

Obuh & Ogheneme [32] highlights the overview of some elements are essential for ensuring hardware as well as software interoperability in library and information systems. It specifically proffers meaning to the term system interoperability and identified the need for interoperability alongside some globally accepted standards and mechanisms

that will guarantee system interoperability. This paper examined library automation, Digital library, Networking, Internet and other standards like Metadata related DCMES, OAI-PMH, catalogue of MARC-21 and Z39.50 standards. Bottlenecks in ensuring operability through standardization were highlighted, the way forward in achieving interoperability among libraries in a library system was also itemized and recommendations were put forward.

The other past research has focused on:

Web Standards and Specifications for LIS Professionals: A Special Reference to W3C [21].

Metadata standard [37].

Library Automation Software: A Comparative Study of Koha [24].

National Library Standards Activities [26].

Library Automation Standards [23].

Standards at the Library of Congress [18].

Standards Requirement for Integrated Library System [22].

Standards for Digital Information [24].

Standard Supported by SOUL Software [8].

Standards in library automation and networking [5].

Libraries and Standards [3].

The Analyzed Layout and Text Object [2].

Library Networks and Network Based Information Services in India [13].

Standards for Library Automation in Korea [14].

Expandability, Flexibility, Compatibility: Key Management Considerations in Academic Library Automation [34].

NISO + BISAC + SISAC + Z39 + X12=CHAOS: An ALA preconference on standards for the acquisition of library materials [42].

Library Standards for Data Structures and Element Identification: U.S. MARC in Theory and Practice [4].

3. Objectives

The main objectives of the study are;

To find out the standards used in the library and information system

To identify the number of standards available and use in different areas in of library and information system.

To focus on the library automation, network and digital library, Web technology specification standards used in the field of library and information system tools.

To find out the problems faced by the ICT based library functions and services without using standards and specifications.

To find out the impact of standards in the different areas of library and information systems.

4. Methodology

The impact of information communication technology is having on ICT based Library and Information Science related standards is a factor in the development of library and information systems. Based on some national and international standard library organizations / associations / websites and some other relevant literature the author finds out some standards and specification websites. As of August 2020, there are six categories of library and information science standards related to data collected from the Internet. The collected data analysed and presented according to American Psychological Association (APA) style methods.

5. Discussion

The technological changes and development of numerous library automation, networking and web technologies using different hardware and software platforms require library software interoperability. Here the main areas of ICT based LIS related standards and specifications are focused as follows;

a. Categories of LIS Standards

This paper highlights the most popular internationally adopted standards and mechanisms for achieving system interoperability in library and information systems are categorized as follows:

1. Bibliographic and Data Management System Standards
2. Metadata standards
3. Information Processing and Retrieval Standards
4. Web Technology Standards
5. Network Standards
6. Digital Library Standards

5.1. Bibliographic and Data Management System Standards

The database related standards are also essential for providing better service to the end users as well as to maintain the specific services. Table 1 shows that only five important bibliographical database standards like ISO 2709, CCF, MARC 21, FRBR, FRAD are in the field of library and information science. This table also highlights the standard origin, and main purpose used in the field of Library and Information Systems.

Table 1. LIS Standards for bibliographical data.

Sl. No.	Standard Name	Year	By	Purpose
1	ISO 2709	1960s	LOC	ISO standard for bibliographic descriptions



Sl. No.	Standard Name	Year	By		Purpose
2	CCF	1984	UNESC		Common Communication Format creating bibliographical records and for exchanging records [35]
3	MARC 21	1988	LOC		Machine Readable Catalogue 21 is a digital formats for electronic library catalogue [15]
4	FRBR	1998	IFLA		Functional Requirements for Bibliographic Records is restructure catalogue databases [8]
5	FRAD	2004	IFLA		Functional Requirements for Authority Data is conceptual entity-relationship model [9]

5.2. Metadata Standards

Metadata is one of the data management and retrieval tool for access and retrieval the information through the web. Table 2 shows that the major 6 metadata standard tools used

in the field of library and information science. The table focus on the metadata tools like DCMES, OAI-PMH, MODS, MADS, MIX, METS and its origin and purpose.

Table 2. LIS Standards for Metadata and other related tools.

Sl. No.	Standard Name	Year	By		Purpose
1	DCMES	1995	Dublin Core		Dublin Core Metadata Element is described as digital resources
2	OAI-PMH	1999	OAI/O		Open Archives Initiatives is a Metadata Harvesting protocol developed by OAI for harvesting metadata descriptions of records in an archive so that services can be built using metadata from many archives [31].
3	MODS	2002	LOC		Metadata Object Description Schema is a schema for a bibliographic element set that used for a variety of purposes, and particularly for library applications [41].
4	MADS	2004	LOC		Metadata Authority Description Schema that provides an authority element set to complement the MODS
5	MIX	2006	LOC		Metadata for Images in XML Schema. It is a XML schema for a set of technical data elements required to manage digital image collections.
6	METS	2007	LOC		Metadata Encoding & Transmission Standard. It is encoding descriptive, administrative, and structural metadata regarding objects within a digital library [19].

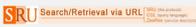
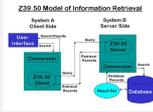
5.3. Information Processing and Retrieval Standards

Without information retrieval tools no one can access / retrieve the information, same way the provider also essential for process and disseminate the information properly. Table 3

highlights the 12 information processing and retrieval tools like AACR2, LCSH, MeSH, RDA, RDF, SKOS, SRU/SRW, UNICODE, Z39.50, Barcode, CQL, EDI.

Table 3. LIS Standards for Information processing and retrievals.

Sl. No.	Standard Name	Year	By		Purpose
1	AACR2	1967	ALA		Anglo-American Cataloguing Rules. It is an international library cataloguing standard rules for library and information science professionals [1].
2	LCSH	1909	LOC		Library of Congress Subject Heading is list of headings produced from the subject authority file [17].

Sl. No.	Standard Name	Year	By		Purpose
3	MeSH	1960s	NLM		Medical Science Subject Heading is a thesaurus that controlled and hierarchically-organized vocabulary produced by the National Library of Medicine [30].
4	RDA	2010	CFLA, ALA, CILIP		RDA is a package of data elements, guidelines, and instructions for creating library and cultural heritage resource metadata [33].
5	RDF	1996	W3C		Resource Description Framework is a family of W3C specifications originally designed as a metadata data model.
6	SKOS	1997	W3C		Simple Knowledge Organization System is a common data model for sharing and linking knowledge organization systems via the Web.
7	SRU/SRW	2013	LOC		Search/Retrieve via URL is a standard synchronous search protocol for Internet search queries, utilizing CQL a standard syntax for representing queries. Search Retrieve Web Service is a companion protocol to SRU.
8	UNICODE	1991	Unicode Consortium		Universal Character Encoding is an information technology standard for the consistent encoding, representation, and handling of text expressed in world's writing systems [36].
9	Z39.50	1988	LOC		An international standard client-server, application layer communications protocol for searching and retrieving information from a database over a TCP/IP computer network.
10	Barcode	2011	Barcode verifier standards		A barcode is a machine-readable representation of data relating to the objects or product to which it is attached [40].
11	CQL	2005	LOC		Contextual Query Language (CQL) is formal language for representing queries to information retrieval systems
12	EDI	2002	XEDI		Electronic Data Interchange is the concept of businesses electronically communicating information that was traditionally communicated on paper, such as purchase orders and invoices [43].

5.4. Web Technology Standards

With web tools one can easily access and retrieve the information but the standards support the quality and further access also. The Table 4 shows that the major 5 web

technology standard tools support for ICT based LIS services. Here only the most popular web standard tools like HTML, W3C, XML, RSS, MARC-XML are discussed [38].

Table 4. LIS standards for Internet and Web.

Sl. No.	Standard Name	Year	By		Purpose
1	HTML	1993	WHATWG		HyperText Markup Language is a markup language for documents designed to be displayed in a web browser [39]
2	W3C	1994	Tim Berners-Lee		World Wide Web Consortium is developing protocols and guidelines that ensure long-term growth for the Web [37].
3	XML	1996	W3C		Extensible Markup Language is a markup language. This is the set of rules for encoding documents in format.
4	RSS	1999	Netscape		Rich Site Summary is a web feed that allows users and applications to access updates to websites in a standardized, computer-readable format.
5	MARC-XML	2002	LOC		MARC – Extensible Markup Language is working with MARC data in a XML environment [16].

5.5. Network Standards

The standards and specifications are essential for data

communications that are needed for interoperability of networking technologies and processes. Table 5 shows that the 5 popular standards (NCIP, SIP, SOAP, JSON, and RESTfulAPI.) highlighted in the field of Library and

Information Science.

Table 5. LIS Standards for Network.

Sl. No.	Standard Name	Year	By	Purpose
1	NCIP	2002	NISO	National Information Standards Organization Circulation Interchange Protocol is a protocol. It is limited to the exchange of messages between and among computer-based applications [28, 42].
2	SIP	1993	3M	Session Initiation Protocol is a protocol for communication between devices.
3	SOAP	1998	Microsoft	Simple Object Access Protocol is a messaging protocol. The layer of a web services protocol stack for web services
4	JSON	2013	Java Script	JavaScript Object Notation is an open standard file format, and data interchange format. It uses human-readable text to store and transmit data objects consisting of attribute-value pairs and array data types (or any other serializable value).
5	RESTfulAPI	2000	Roy Fielding	Representational State Transfer application programming interface description languages are formal languages. It designed to provide a structured description of a RESTful web API that is useful both to a human and for automated machine processing

5.6. Digital Library Standards

Standards help in creating, maintaining, and processing in the area of digital libraries also. It allows different modes to compete on the basis of the quality of their products while

being compatible with existing resources and facilities. Table 6 highlight that Library of Congress build 4 out of 5 digital library standards.

Table 6. LIS Standards for Digital Library.

Sl. No.	Standard Name	Year	By	Description
1	ALTO	2009	LOC	The Analyzed Layout and Text Object was initially developed by the META e project group to use with the Library of Congress' METS.
2	PREMIS	2002	LOC	PRE servation Metadata: Implementation Strategies (PREMIS) is a comprehensive, practical resource for implementing preservation metadata in digital archiving systems.
3	Text MD	2007	LOC	Text MD is a XML Schema that details technical metadata for text-based digital objects.
4	Audio MD and video MD	2000	LOC	Audio MD and video MD are XML Schemas that detail technical metadata for audio- and video-based digital objects.
5	ASTM	2001	ASTM	American Society for Testing and Materials, is an international standards organization that develops and publishes voluntary consensus technical standards for a wide range of materials, products, systems, and services.

6. Conclusion

Standards are guidelines or rules for products, processes, test methods, or materials. The software package should support library automation, database construction, information process, retrieval, and sharing the information easily and effectively to the end-users with specific standards. The software requires at various levels of operations in the network, automated, processing, and sharing the library resources. The common standard should maintain in the areas like network protocol, database, resource sharing, web technology, information process, retrieval, security, and so on then only the library should provide better services to the end-users. In this article the author focus on the 5 categories of library / information products, resources, facilities and services standards like Bibliographic and Data Management System Standards, Metadata standards, Information Processing and Retrieval Standards, Web Technology Standards, Network Standards.

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