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Metadata and Resource Management in the Digital Age: A Duo-decadal Bibliometric-Narrative Map and Assessment

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Abstracts

The library is saddled with the responsibility of meeting the needs of patrons which in this digital era/age is a function of proper management of information resources. Though, the manual metadata (library catalogue) has been employed as a tool for the management of resources, the influx of non-organized digital information resources calls for modern ways of management which is the use of sophisticated database management system (DBMS) in a digitized library. the study investigated metadata and resource management in the digital age: a duo-decadal bibliometric-narrative map and assessment. It emphasize and appraised the relevance of metadata and information resource management in the digital age with a view to appropriately apply and implement the term "metadata digitization" as a tool in library resource management in the digital era. The two-cluster study employed a narrative-bibliometric assessment and adopted the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guideline to retrieve documents from relevant database (Web of Science and Scopus). The bibliometric-narrative review of related details include: the description of the concept of metadata, types used in information resource management structure, the usefulness and application of metadata and challenges in the digital age. A total of 3411 documents were globally recovered with date/time ranging from January 2000 – 2022 December at 12:12 am 1/5/2023. It revealed that although the concept of 'metadata', its structure, categories, classes, application has been employed by various related investigators/countries in diverse field of study, it has not lived up to its relevance. The study has shown that the term has been used by different authors, institutions and countries with a low collaboration index of 6.56, yet there is a geometric increase in the yearly/annual distribution of documents-metrics on metadata and information resource management globally. In addition, authors productivity and keywords occurrences are very high with increasing yearly numbers of publication. This indicates that the implementation and application of the term yet remain low. A lucid drive towards the appropriate application and implementation of the term "metadata digitizing" as a tool in library resource management in the digital era is suggestive.

Keywords: Metadata; Resources; Resource management; Digitalization of information; bibliometric-narrative of retrieved documents

1. Introduction

Information resources in the traditional library have been described manually for easy accessibility and retrieval, however in current global advancement and technological era of information explosion; these resources are digitized and described electronically. According to Kumar (2009) as cited in Igere (2020), a great change has occurred in academic libraries as a result of the adoption of information communication technology thereby affecting the description of both books and non-book materials. That is to say, libraries in this technological

period are emerging with notable advancement as it now manage its resources through proper description which reflects original documents most especially in electronic formats. Furthermore, Igere (2015) also supported that there is a great effectiveness in accessing and retrieving information using advanced technological description of resources. Dashrath (2014) also added that the bibliographic description which is embodied with indexing and abstracting often serve as surrogates to original materials known as metadata. The term metadata with the prefix meta means "about or a whole of", while data entails description of information. In essence, metadata is a brief set of information or data with references which describes and gives information about other data and can be used to retrieve a larger set of information. It is the information about other data where the other data in libraries are usually information resources (objects) like books, government publications etc. (Laxmaiah & Govardhan, 2013; Umar, 2018; Metadata History and Evolution, nd; Long, 2008). These definitions of the term "metadata" have shown that it has been in existence, applied and practiced manually in traditional libraries which are now applied wholesomely as electronic format in digital libraries. The term metadata came from the field of computer science and was first coined by Jack Meyers in the late 1960s but appeared in database management in 1980 and became useful (by making accessible to users computer files) in 1990. The term was furthermore added into librarianship in the earlier dates of 1995 creating and promoting Dublin Core Metadata element (Metadata History and Evolution, nd). Prior to the emergence of the term metadata, description of a whole information as well as management of information resources was poorly represented however, following its origin and introduction; there had been a growing interest in appropriate management of information resources with diverse strategic application for easy accessibility in libraries. Although there are notable advantages of the digitized application of the term metadata as opined by various investigators, its acceptability, global spread, applicability and information retrieval tendency yet remain a mirage among most emerging librarians and scientist as suggested previously by Igere and Igere (2021). This implies that the applicability and acceptability needs to be appraised to arouse interest in harnessing the information retrieval tendency and its implementation. Such drive has also arouse the need to categorize and classify the various area of metadata as described by most related investigators. This drive necessitated Dashrath, (2014) and other related researchers to categorized metadata into three broad/major types which are descriptive metadata, structural metadata and administrative metadata, while the classes includes right management metadata, technical metadata, amongst others as described in figure 1 below:

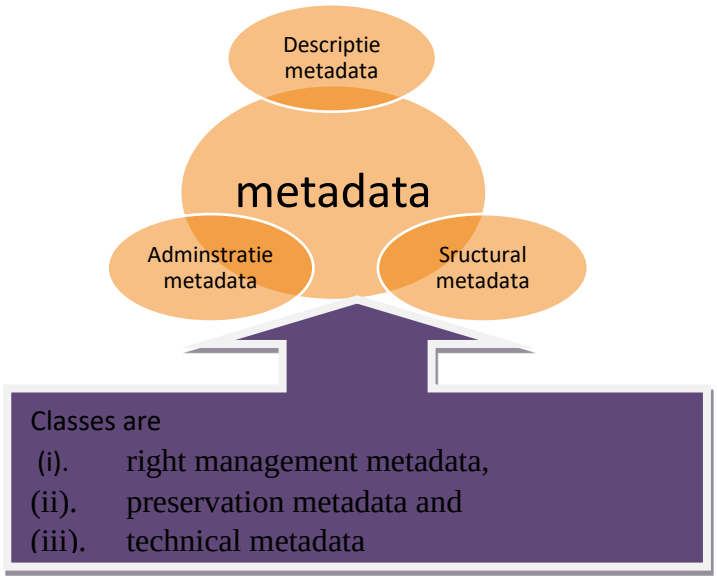

Fig 1: Categories and Classes of Metadata for information description and accessibility

Other included classes are the right management metadata, preservation metadata and technical metadata (chapter 1 introduction, types of metadata Role, nd). Metadata is structured in a way that various attributed sets of data or elements are put in place to describe the resource. For instance, when elements such as author, subject-specific search, title specific-search, language, place, date of publication, subject covering, and call number is co-applied with a highly structured and searchable resource which emphasized on a sophisticated database management system (DBMS) in a digitized library (What is Metadata, nd), it creates a whole information or metadata. Such metadata creation may be represented as the library model, submission model and automated model which are useful in quick search of files and then stored and managed (Chapple 2020). These stored and managed files are, the metadata (meta tags in HTML), metadata only (traditional library catalogue, electronic resource management ERM) and service only (Google or Yahoo, Pubmed, Scopus etc.).

Preminger, Rype, Ådland, Massey, and Tallerås, (2020) recently stated that in digitized libraries, the cataloguing standard of Anglo-American Cataloguing Rules (AACR) has been replaced with the Resource Description and Access (RDA) which emphasizes the relevance and applicability of metadata. The application of metadata begins with development of schemes whereby a user structures and provides an algorithm which is the semantic language identified by such database to filter and represented as XML (extensible markup language) or other format. Some of such coded algorithms may be presented and/or downloaded in PlainTex file format. Although according to Pal (2010), one of the challenges of applying metadata is the cost associated with data generation as well as the changes and conflicting reports with known standard. Other reported challenge may be the rigor associated with developing a database acceptable algorithm, the appropriate use of relevant syntax for the retrieval of documents as well as appropriate application of specific regulatory guidelines and governing bodies. Some known metadata governing standard body and regulatory guidelines include Preferred Reporting Iterms for Systematic Reviews and Meta-Analysis (PRISMA); the Dublin Core or open Geospartial consortium which developed the Dublin Core metadata element set (DCMes), eGMS (electronic Government metadata standard, geographic information metadata) etc. (Higgins 2007; Igere et al., 2022). As a result of the aforementioned concerns on the application and usefulness of digitized metadata, the current study aims to determine metadata and resource management in the digital age with a view to appraise the need for appropriate application and implementation of the term “metadata digitization” as a tool in library resource management in the digital era. To accomplish this aim, the study emphasizes on the following objectives: description of the concept metadata, types of metadata used in resource management, structure of metadata, use of metadata for resource management and challenges of metadata in the digital age. The study adopted the Preferred Reporting Iterms for Systematic Reviews and Meta-Analysis (PRISMA) guideline to retrieve documents from relevant database (Web of Science and Scopus) for the bibliometric-narrative review of retrieved details.

2. Review of Related Literature

Description of the Concept Metadata

Metadata as a concept, describes or provides information about a data or resource in order to fast track or create quick access to the original documents. Krantz (nd) define metadata as any small data which describes other data by helping to identify and/or sorting the characteristics of the information been described. Furthermore, metadata with the prefix meta means to describe by summarizing basic information (such as author, creation date, modified date etc.) of a data to enable easy retrieval and use. In order words, metadata could be related to the

library catalogue (manual) which emphasizes the description of information resources using the information in the documents such as name of the author, title, year of publication etc. that is also done electronically through MARC, OPAC and some other online databases for easy retrieval and usability. Igere (2022) also stated that the catalogue as a tool with the features such as author, title etc. describes resources thereby serving as index to the actual documents for easy access and retrieval. This is related to the metadata which is regarded as mini information either manually or electronically from a whole data thereby directing an individual to the main data or document.

Kranz (nd) noted that metadata could be created manually (where relevant information that would be described and sources are imputed) or by automated information processing (to display information such as file size, creator of the file, year of creation). Thus, metadata now serve as a surrogate to the original data or documents that are online most especially in this digital age where libraries are automated. According to Chapter 1 introduction, types of metadata Role (nd), it was revealed that the influx of information most especially online that are not managed or organized properly leads to deficiency in retrieval. These unorganized online or web information calls for proper management hence, the need for metadata to provide proper management of resources for effective retrieval of information network. The International Federation of Library Association (IFLA) cited in chapter 2 (nd) defines metadata as data used to identify, describe and locate networked electronic information resources. Metadata encompasses a machine readable language or web information that the machine understands. It may be applied daily through the library catalogue in a card or book form to describe the content of a document. Furthermore, it is applicable in our everywhere activities and area of studies especially in this digital era where information is in the space. Igere (2022) also noted that it is created for proper orgaisation to salvage the problem of accessing and retrieving information resources. Instances of metadata application is revealed in the subject of our email through the dates of creating the file, the last person that accessed it, the sensor data in our smartphones to the latest movie searched for on Youtube etc. Riley (2017) stated that Instagram also ensure captions on images are created, uploaded, shared and follow other business users and account. Also, users of twitter manage the list of those they follow, post media and text, use hashtags to comment and connect to others, retweet others content, favorite tweet, driving features like twitters trending topic list all in a way to manage resources for effective retrieval. What is metadata, (nd) further stated that metadata create automatic association of relevant elements of digital object by organizing them for easy discovery. According to Data management glossary (nd) metadata is use in the management of data that are not structured in order to provide ways of identifying various classes of data. It could be stated that there are a lot of information online in this era of information growth that needed to be managed properly to create accessibility hence the need for metadata.

Understanding metadata (2004) described metadata as information that is structured by describing, explaining, locating as well as making it easy for retrieval and usage thereby creating effective management system for information resources. Metadata could be used by some as records which describes electronic information resources and others refer to it as machine understanding information. Furthermore, metadata can be use to describe digital and non digital resources. The traditional library has been using cataloguing as a form of metadata such as MARC 21 with the set of rules like AACR2 as standard (Understanding metadata, (2004). Hence metadata may be seen in synonym with library catalogue as it can be use to describe a single or a whole collection. Metadata can be embedded in a digital object like the HTML documents or stored separately to simplify and manage data for quick search and retrieval.

Riley (2017) describe metadata as the key to the functionality of the system holding the content of information such as pictures posted in Instagram, video on Youtube, online music, finance management online, connection through email, text and social media which enable users to find items that are of interest to them, record important information and share such information with others. In other words, most of the software (endnote referencing and Mendeleey) used in our daily life and research has metadata features which organize resources for easy retrieval.

Riley further noted that there are metadata embedded in web pages to link from a particular web page to another showing users view from list of search results and also there are knowledge graph and other structured metadata in Google (like sport scores, search results with maps, knowledge cards on search result on notable people and places) that are used to search for needed information. Farooq (2018) similarly noted that most web pages has meta tag as metadata used in describing web content pages such as the description of a text (indicating the author, year of publication, short summary of the document) and the description of images (indicating size of the image, colour, year the image was created). In the business world, metadata also create features such as purchase history or transaction made, shipping location, products recommended and searches made to enable statistical assessment and predict future sales or progress. Metadata application strategies are used by media house in tracking, covering and publishing content while in the travel industry, it is used to get information on passengers, booking, flight and hotel rooms (Riley 2017).

Types of Metadata Used in Resources Management

The application of metadata helps to provide information on every area of a data thereby summarizing some basic information about a specific data in other to track and make appropriate use of the data. It further gives a description on how a data was formatted, how, when and by whom a data was collected as well (Farooq, 2018). There are various categories of metadata that supports management of information resources in this digital world. NISO (2004) cited in Understanding metadata (2004) identified the major types of metadata to be descriptive, structural and administrative metadata (Fig 1), while others ensure preservation and management. Descriptive metadata describes resources using the elements like title, abstract, author for user to easily discover and identify. Similarly, Dashrath, (2014) noted that metadata in the descriptive category makes provision for the source or the resources by creating easy and quick search to locate it. Kranz (nd) further stated that descriptive provide bibliographic information found in any resource to manage the influx of information in this digital world. In the same manner, Chapter 2 Meta history and evolution (nd) visualize metadata as the description of resources to ensure resources are easily discovered, identified and selected which would also help to co-locate and acquire resources. This implies that metadata in the descriptive category creates or makes provision for information resources using the bibliographic information found in the resource to describe it for proper management and easy retrieval.

The second major category of metadata is known as **s**tructural, which is defined as the arrangement of objects which can also be regarded as resources into a compound form or put together in an organised way. A good example is the arrangement of the pages of a book in other to form a chapter (Understanding metadata, nd). Agnew (2004) opined that the structural metadata are patterned to give a structural relationship which exists among complex objects (such as information resources) which enable individuals to browse through table of content, Pages of books in an orderly manner and also move to a chapter that is selected. According to

the Chapter 2 metadata history and evolution (nd), it was stated that with structural metadata, physical files are processed, managed, preserved and displayed for users. It gave example of how structural metadata application can help to order pages, chapters of an information resource etc. Farooq (2018) further described how structural metadata helps in the organisation of the components of an object which could be likened to an orderly arrangement of pages to form chapter of a book. It could be noted that, structural metadata gives an orderly arrangement of resources in a presentable way to depict or reflect the various components and how they are related in an orderly manner thereby creating an avenue for proper management, organisation for easy access and retrieval for usage.

The third major category of metadata is the administrative which makes provision for information such as how and when the creation of files took place, who accessed the file, other technical information which help as a way of managing resources. It could be summarized as the description of the owner and production of a digital file (Understanding metadata nd). The Chapter 2 metadata history and evolution (nd) stated that the administrative metadata application acts as a facilitator to the management of resources indicating resource creators, controller and archivist to the content of the resource and access to the resources. Though, the administrative metadata is somewhat similar to descriptive metadata because they both use similar elements. For instance, accession number can be use in the administrative metadata as a way to acquire resource while it can also be used under the descriptive metadata as a means of identifying an information resource. Introduction to metadata (2018) noted that there are two subsets of administrative metadata (preservation metadata and right management metadata) that are usually discussed separately as other types of metadata.

Preservative metadata is purposely meant to archive and preserve information resources for future use. Information resources can easily decay or get destroyed by human or other natural factors but the only way to keep these resources is to get them preserved and this can be easily done through digital preservation in this digital era (Chapter 2 metadata history and evolution, nd). There is need to migrate the format of the resource and as well emulate current hardware and software behaviour to the future platform as a way to overcome the challenges of corrupted or altered problems of resources that lead to non-usage. Furthermore, preservation metadata is all about technical management and specialized format of administrative metadata which provide the authenticity, integrity and originality of resources that are kept digitally with emphasis on longevity of the resources and the future (Chapter 2 metadata history and evolution, nd).

Right management metadata on the other hand is specifically on the intellectual property right of the resource. The right of any resource is meant to be managed to avoid misuse of resource. According to Chapter 2: Metadata History and Evolution, (nd), it was stated that there is need for resources to get to the right source at the right time. In this digital era, the various organizations with broad information or resources need right management and this has brought about the digital right expression language (DREL) that would be applicable or useful by automated system.

Metadata Standard/ Schema

Metadata standard is regarded as a uniform set of rules created/designed by international governing organsations (such as IFLA- International Federation of Library Association, ISO- International Standard Organisation, W3C- world wide web consortium, NISO- National Information Standard Organisation) in order to ensure consistency in the management of

information or resources and also to support interoperability of applications and resource sharing (Smith, Breytenbach & Groenewald 2007). Hillmann , Marker and Brady (2008) described metadata standard and its application in three perspective as; first, a schema or scheme also known as format or sets of elements (like the Dublin core, MARC 21, MODS-Meta data Object Description Schema, ONIX-Online Information eXchange etc.) which is used in describing information resources; secondly, the content standard or rules reveal the value given to metadata elements specifically, contents rules for content formulation (like identifying main title,) and content representation rules (like capitalization). The content rule is in most cases applied in the traditional cataloguing with the use of AACR2 to create access or search through consistent data entry. Although, most metadata standard do not refer to content standard but some have guidelines for content and they use AACR2 or RDA. Thirdly, is the syntax rule or standard (such as HTML- hypertext markup language, XML -extensible markup language, RDF -resource description framework) which focuses on the semantics used in describing resources to facilitate the movement of information. All of these content and semantic rules of metadata applications are embedded in the scheme/standard designed to facilitate proper organisation of resources. Hence, Farooq (2018) noted that standards are designed to agree on a particular format or scheme, which encompasses languages, spelling, etc. to be used to ensure uniformity because if different standard are adopted, it will create difficulty in comparing data in various organizations. Metadata standards therefore ensure schemes or formats are put in place for uniformity all data over the globe such that the application of metadata is therefore controlled by the schemes that have been developed by the international organizational standard.

Farooq, (2018) define metadata scheme as the entire structure for metadata creation which gives a description of how metadata is set up with emphasis on some common components such as names, places, dates. Similarly, metadata schemas and standard (2022) stated that metadata scheme gives common elements or attributes that is adopted by a standard organisation like the International Organisation for standardization to describe data in a uniform way. In essence immediately a scheme has been accepted and adopted by a standard organisation, it becomes a metadata standard.

Metadata standard/ schemas could be generic and domain specific. Generic standard are widely adopted and easy to use though with expansion to cover specific information. Domain-specific schemas are specialized and richer in vocabulary to be understood by researchers in a particular area and location of study. Examples of the application of metadata standard based on general purpose include: Dublin Core which is a general standard that was first used in libraries and also adapted in specific area of studies, MODS-Metadata Object Documentary Schema which can be used on its own in compliment to other metadata format. For the specific subject area, some of the examples are the Data Documentation Initiative standard that is used by social scientist for the description of data, OLAC -Open Language Archives Community which creates open language to archives initiatives. Numerous metadata schemes have been developed to be according to discipline. Some of the most common schemes that has been developed to support proper management of information resources according to Higgins (2007) and Chapter 1 introduction, types of metadata Role (nd) are as follows:

1. Dublin Core metadata: This is one of the best metadata standards that was design in 1995 as a core set of elements to describe web page content to facilitate search and retrieval of resources. The Dublin core metadata is made up of 15 elements (Title, creator, subject, description, publishers, contributors, date, type format, identifier, source, language, relation, coverage and right) which address the various elements of

metadata (descriptive, administrative and technical) which are needed to identify digitized resources. This scheme is designed to support the functions and needs of different community at a time. For example, we have the Dublin Core collection Description Application profile which can be used to describe whole collections while the Dublin core Library Application Profile which can be used to describe published library holdings .XML is made available to be used to refine the semantics of the elements to discover resources.

2. e-Government metadata standard (e-GMS): This is a metadata scheme which is used by public sector to manage their resources. It enables consistency on organisation of information resources across government and public sector organizations.
3. Metadata Object Description Schema (MODS): This is a descriptive metadata scheme that is derived from MARC 21. It makes use of the XML with the intention of carrying selected data from existing MARC 21 records so as to create original resource description. In order words, it uses language tags rather than the numeric used in MARC 21 records.
4. Metadata Encoding & Transmission Standard (METS): This is a metadata standard that is used to encode descriptive, administrative and structural metadata as regard to objects within a digital library. It makes use of XML schema language of the World Wide Web.
5. Machine Readable Cataloguing (MARC): This is an international standard used by libraries worldwide to represent and communicate bibliographic information in a machine readable form. It allows the share of library catalogue records.
6. Online Information exchange (ONIX). This is an international standard which represent and communicate information about book industry by giving information about publishers books to retailers and wholesalers.
7. Encoded Archival Description (EAD) are used as a way to markup data so that they can be used to search for archives and special collections online.
8. Gateway to Educational Materials (GEM) provide access to Internet educational resources that are not catalogued but are owned by non-commercial, profitable, federal, government, university internet sites.

Use of Metadata for Resource Management

In this digital age, libraries has gone through the phase of describing, organizing and managing information resources through the traditional ways to using various metadata scheme in proper management of the resources in the library. Yanez, (2009) specified that digitizing information resources in the library is a way to actualize the goal of effective management of resources in this digital era. A collaborative work of the special collection and cataloguing department of libraries that are undergoing their first phase of digitization is needed. Yanez further stated that while archive and special collections are put as the first target for digitization, the use of OCLC products that are user friendly and could allow library staff contributes to metadata records without involving the Dublin core experts is also necessary. The digital collection management for users is the CONTENT dm which allows users to easily search and have access to resources. There is also CONTENT pro which emphasizes building of collection, managing interface and interfacing for end users. It is regarded that both the CONTENT dm and CONTENT pro are Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) which allow interoperability standard for repositories. (Yanez, 2009).

Metadata is design majorly to manage information resources for easy and quick retrieval of the resources. According to Dashrath (2014), metadata function as faster and precise tool for

searching, identifying, choosing, assessing and documenting network resources. Other functions also identified by Dashrath includes organisation of resources in line with address, subjects etc. creation of separate informational entry for identification, provision of multiple access to information entry. analyzing and indexing large amount of network information without network band width, preservation and conservation of digital data, identifying and separating dissimilar resources, suggesting location of information and legal information on condition of users, suggesting ownership and creator of a source by establishing link e.g. email address, recognizing data structure, allowing interaction and assessment of resources, showing relationship of previously and subsequently used sources and deciding form and frame of data to be recalled. Other five purposes of metadata has been outlined as description and identification of resources (using tools such as RFID CODES, ISBN, DOI etc.), disseminating and retrieving information from lots of information that are online (with the help of several metadata standard such as Dublin Core), retaining and preserving information (with metadata standard like Preservation Metadata Maintenance Activity PREMIS), description of various types of access right and protocols, ownership and right of an information resource online (Introduction to metadata, 2018).

Chapter 2 metadata history and evolution, (nd) similarly stated that without metadata, lots of information online will not be organized for use. Some of the functions of metadata pointed out are as follows:

1. Discovering of Resources: metadata describes electronic resources by providing information on the resource title, subjects, abstract of either a single resource, part of a larger collection, photograph or image in an article or collection of library resource as a whole which create room for quick discovery of resources.
2. Increased access to resources: multiple resources and virtual collections from information resources in library repositories can be searched for through metadata thereby creating effective access to resources.
3. Retention of contexts: metadata has the ability to maintain resources that are complex in relation to other resources with regards to places, event, people and movement. Metadata could be used to manage each single collection from a complex or group of resources and still maintain the original context of the resource through documentation of the relationship, authenticity, structural and procedural, integrity, degree of completeness of such information resource.
4. Expansion of use: metadata expand services to users on areas such as museum and archived information resources around the globe which users would not have had interest on viewing may be as a result of distance, economic or other barriers.
5. Multiple versions of the same source: metadata link multiple version arising from the same source and also distinguishing the difference in qualities of different resources in digitized and hard format of information resources.
6. Legal right: information resources in repositories are tracked with the aid of metadata to define the right and reproduction placed on information resources and its multiple versions.
7. Preservation: The migration of information resources through a successive generation of computer hardware and software or moving to a new means of delivering information independently for storage and retrieval can only be effective with metadata. Metadata technically describe and preserve information on the creation, maintenance, its behaviour and relationship with other information resources.

Challenges of Metadata in the Digital Age

Various problems have been associated with metadata including that of disparate initiative which emphasizes the distinct views on usage and application of metadata. Individuals and organizations have their unique ways of understanding and managing metadata which bring about many cases of missing metadata relationship. Different types of data exist and there is need to manage metadata from both business and technical perspective because those involved in IT development needs to go through the technical rules and relate to the business rule of the metadata to see if there is any discrepancies if not, it becomes impossible to manage the metadata. Other problems are associated with the ones typically built by non-metadata professionals. It is important to note that, some metadata are built by consultant and employees that are not qualified thereby creating problems in usage. Costly implementation, maintenance and poor selection of technology are also additional problems associated with metadata (Marco, 2021).

Layton, (2013) noted that storage and search system using metadata is also a rare metadata problem because, sometimes it is difficult to identify where you store information in metadata to retrieving it. This might be associated with how the system for organizing information resources in the library is developed. Apparently, some systems are not user friendly and this will hinder accessibility, retrieval and usage. Beall (nd) also identified some of the problems with metadata as not having full access to information resources most especially when metadata is used as a means of organizing information resources in the libraries that are digitized. Furthermore, images stored using metadata are also expose to the similar problem of non accessibility. It is also expensive to harvest metadata and access broader range of information resources that are in digital format. Errors such as transmission error, incompatible data elements, corruption of eclectic metadata when converted to multiple are bound to happen while harvesting. Beall concluded that though the importance of metadata in the digital age cannot be over emphasized, but when there is deficiency in the benefits attached to metadata usage, there is bound to be difficulty in accessing resources that are set to be managed by metadata.

Similarly, Sulehri and Warraich (2020) pointed out unawareness of some individuals and organizations on the usefulness of metadata, lack of skills in using metadata as well as maintenance of metadata as challenges. There is also the problem of metadata creation, management, non-provision of guidelines in describing resources, non qualified or inexperienced metadata specialists and digitization consultants. Furthermore, there are problems experienced while harvesting untitled metadata as well as the occurrence of varying structure as a result of harvesting metadata from multiple sources affect quality, content standard and schemes thereby leading to inconsistency, unreliability and non-usability. Curation of large scale metadata, Incompatibility of data elements, junked Unicode characters, incomplete harvesting, multiple record harvesting, and connection time out are also challenges faced. Typographical error is also a problem as cross walking metadata from a particular format to another can lead to source error as well as corruption of metadata during conversion to another scheme.

Methods of Bibliometric Map and Assessment

Various articles on metadata were retrieved including book chapters, data paper, meeting abstracts, proceedings of conferences, editorial materials research articles, review articles etc. from both the Web of Science (WoS) and Scopus core databases using the title search term

with algorithm and Boolean as "Meta Data OR MetaData AND Resource management" to retrieve all available reports on metadata and resource management with due consultation by IMA. Accessed documents were indexed by global relevant organizations which were retrieved on 12:12 am on 1/5/2023 as applied by Onohuean and his colleagues (Onohuean et al., 2022). The use of WoS and Scopus core database was informed by the universality, veracity of published studies and applicability of information for the study. Only identified articles that conform to criteria of inclusion was retrieved and downloaded in PlainTeX file format while other published documents that does not conform/non-conforming were excluded. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and as we have reported in our previous studies were followed for this study (Moher et al., 2016; Igere et al., 2022a; Onohuean et al., 2022a).

Search Strategy

WOS and Scopus core collection databases, were searched using the phrases ("Meta Data OR MetaData AND Resource management") to find datasets for two decades (January 2000 and December 2022).

Inclusion and Exclusion Criteria

Only articles that contain any of the search term or word ("Meta Data OR MetaData AND Resource management") were applied.

3. Data Analysis

All recovered articles that met the inclusion criteria for the study were applied with a content evaluation of the documents while other non-complying data as well as incomplete documents relating to metadata and resource management were removed and/or excluded. A descriptive statistical survey was used in analyzing all retrieved information while results were presented in simple percentages and tables. The thematic frameworks of studies and authors/institution/countries collaboration networks are describe by VOS-viewer and presented in view-charts using RStudio v.3.5.1 software. The algorithm, Boolean, codes and commands which is applicable in bibliometric analysis (https://www.bibliometrix.org) was adopted to determine the bibliometric dynamics such as annual production rate, annual growth rate, total citations per country, top articles per citations, corresponding authors countries, most productive authors, collaboration networks, most relevant sources, keyword co-occurrence, most cited articles (Onohuean et al., 2022b).

Results of the Bibliometric Map and Assessment

On the WoS core data collection database within the two-decadal retrieval period, a total of 5,515 articles were collected with excluded documents details as follows: Meeting Abstract (981), Review Article (924), Proceeding Paper (474), Letters (244), Editorial Material (139), Corrections (136), Early Access (68), Book Chapters (35), Data Paper (23), Book Review (5), News Item (3), Retraction (2), Books (1), Retracted Publication (1). In addition, articles that were published in diverse language were also excluded including German (5), French (3), Spanish (2), Chinese (1), Turkish (1). This yielded 2,433 articles from Web of Science Core Collection base as shown in Fig1 below. Whereas on Scopus core collection database, the two-decadal retrieval period showed a total of 2,396 document with excluded articles as follows: Review articles (646), Conference Paper/documents (549), Conference Review articles (58),

Book Chapters (30), Books (6), Data Paper (5), Erratum (4), Letter (4), Note (3), Editorial (2), Short Survey (2). The articles that were published in other diverse languages were also excluded including the following Chinese (26), Spanish (10), German (6), Russian (2), Hungarian (1), Norwegian (1), Persian (1), Turkish (1). The included articles numbers after all exclusion in Scopus were 998. The total number of articles applied for the study for both WoS and Scopus core collection database were 998 + 2,433 = 3411.

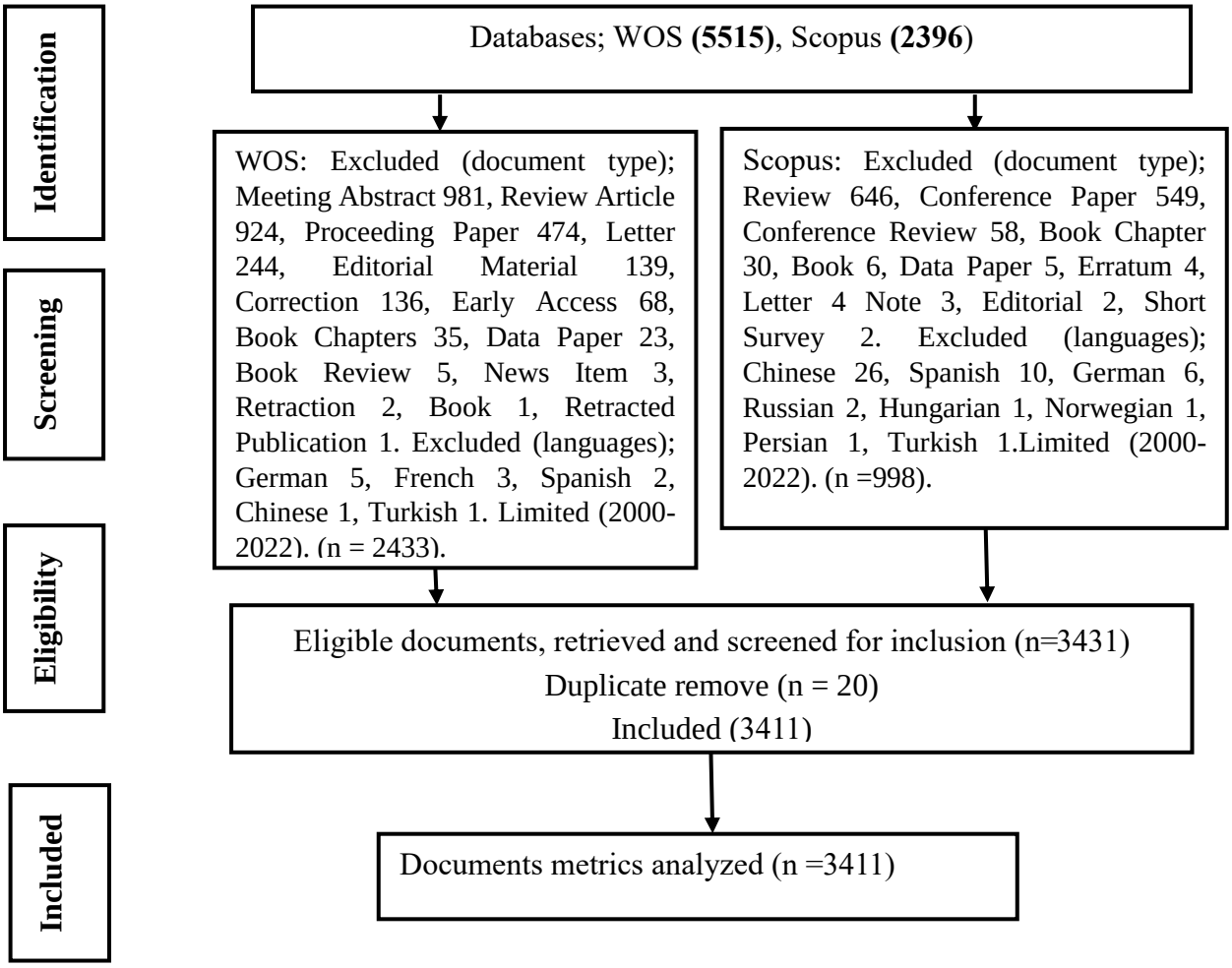

Fig 2: PRISMA process, Schematic Representation and Flow diagram of searching, reviewing and selecting of articles on metadata and information resource management

Discussion

The study appraises the necessity for application and implementation of metadata and information resource management in the digital age. It emphasized and described the relevance as well as the importance of metadata in digitized library. The figure 1 described the categories and classes of metadata for information description and accessibility of the term. This would enhance the usability, applicability, implementation and appropriate management of information resource as previously opined by various related investigators (Preminger et al., 2020; Umar, 2018, Dashrath, 2014). The study also applied the bibliometric and narrative review structure to map and assess diverse authors, institution and countries application of the subject, research related collaboration and how its application may enhance the retrieval of documents. It was also applied in this study using the PRISMA guideline. Figure 2 shows the

flowchart of the PRISMA guideline as it is applied in the retrieval of articles globally. It shows a total of 3431 articles/documents, however after duplicate removal (n = 20), a total of 3411 articles gotten were retrieved and analyzed.

The Table 1 shows the main Information of dataset on metadata and information resource management. It shows that 21645 authors have been involved in the application of the search term with authors appearance been 30723, single-authored documents as 117 and multiple-authored documents as 21528. It was also observed that the collaboration index of authors was 6.56 while documents per author's index were 0.158 (Table 1).

Table 1: Main Information of dataset on metadata and information resource management

Description	**Results**
Timespan	2000-2022
Sources (Journals, Books, etc.)	1582
Documents	3411
Average years from publication	7.13
Average citations per documents	60.68
Average citations per year per doc	6.069
References	145599
DOCUMENT TYPES	
Article	3411
DOCUMENT CONTENTS	
Keywords Plus (ID)	15277
Author's Keywords (DE)	8585
AUTHORS	
Authors	21645
Author Appearances	30723
Authors of single-authored documents	117
Authors of multi-authored documents	21528
AUTHORS COLLABORATION	
Single-authored documents	131
Documents per Author	0.158
Authors per Document	6.35
Co-Authors per Documents	9.01
Collaboration Index	6.56

Figure 3 describes an overview of yearly distribution of published articles/documents metrics on metadata and information resource management. It revealed that from the year 2000 to 2022 of the assessment period, details on the subject has been applied with an increasing published metrics between the two-decadal assessment. It is important to note that at some point within the assessment years, there was a decline in publication metrics which include year's 2003, 2006, 2011, 2017 and 2022 (Fig 3).

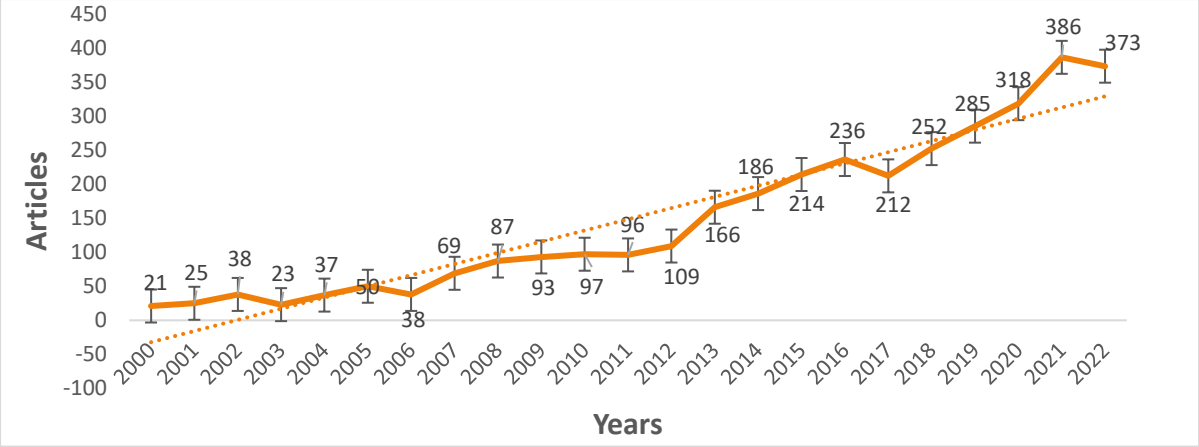

Fig 3: An Overview of yearly distribution of documents-metrics on metadata and information resource management

The below Table 2A and 2B shows the productivity of authors within the assessment period, their Countries, affiliations and Sources/Journal on metadata and information resource management. It revealed the listed authors as the most productive with Riley R ranking the first and having 38 articles (publication index of 1.11) on the subject while Baigent C rank the least with 18 articles (publication index of 0.53). the source/journal that rank the most with publication on the subject was Plos one with 106 articles (publication index of 3.11) while science of the total environment ranked the least with 15 articles (publication index of 0.44). The affiliation with the topmost articles was University of Oxford with 329 articles (articles index of 9.65) while London School of hygiene and tropical medicine was the least in the rank with a 93 articles (articles index of 2.73). The United States of America ranked the first amongst countries which is followed by United Kingdom while Denmark ranked the least as shown in Table 2B.

Table 2A: Most productive (Authors and Sources/Journal) on metadata and information resource management

Authors	Articles	Articles % of 3411	Sources	Articles	Articles % of 3411
Riley R	38	1.11	Plos One	106	3.11
Wang J	36	1.06	Statistics in Medicine	78	2.29
Van	34	1.00	BMJ Open	70	2.05
Zhang Y	31	0.91	Lancet	53	1.55
Cuijpers P	28	0.82	Research Synthesis Methods	46	1.35
Lee J	27	0.79	Bmj-British Medical journal	38	1.11
Benedetti A	26	0.76	Systematic Reviews	36	1.06
Li Y	25	0.73	Plos Medicine	35	1.03
Wang Y	25	0.73	BMC medical research methodology	34	1.00
Pignon J	23	0.67	Journal of clinical epidemiology	32	0.94
Mol B	22	0.64	BMC bioinformatics	26	0.76
Zhang L	21	0.62	Scientific reports	25	0.73
Chen Y	20	0.59	BMC medicine	24	0.70
Higgins J	20	0.59	Stroke	21	0.62
Wang X	20	0.59	Lancet oncology	18	0.53
Emberson J	19	0.56	Bioinformatics	16	0.47
Kim S	19	0.56	Health technology assessment	16	0.47

Lee S	19	0.56	Statistical methods in medical research	16	0.47
Zhang J	19	0.56	Journal of clinical oncology	15	0.44
Baigent C	18	0.53	Science of the Total Environment	15	0.44

Table 2B: Most productive (Affiliations and Country) on metadata and information resource management

Affiliations	**Articles**	**Articles % of 3411**	**Country**	**Articles**	**Articles % of 3411**
Univ Oxford	329	9.65	USA	614	18.00
Mcgill Univ	195	5.72	United Kingdom	532	15.60
Univ Amsterdam	171	5.01	China	327	9.59
Univ Med Ctr Utrecht	154	4.51	Netherlands	214	6.27
Univ Toronto	150	4.40	Canada	177	5.19
Mcmaster Univ	136	3.99	Germany	167	4.90
Univ Sydney	136	3.99	Australia	134	3.93
Vrije Univ Amsterdam	123	3.61	Italy	125	3.66
Karolinska Inst	114	3.34	France	121	3.55
Univ Edinburgh	114	3.34	India	67	1.96
Univ Calif San Francisco	110	3.22	Spain	64	1.88
Univ Calgary	106	3.11	Japan	58	1.70
Univ Melbourne	106	3.11	Iran	55	1.61
Univ Bristol	104	3.05	Switzerland	54	1.58
Univ Groningen	104	3.05	Korea	47	1.38
Univ Birmingham	98	2.87	Greece	43	1.26
Univ Washington	98	2.87	Brazil	38	1.11
Stanford Univ	95	2.79	Belgium	37	1.08
Leiden Univ	93	2.73	Sweden	35	1.03
London Sch Hyg and Trop Med	93	2.73	Denmark	34	1.00

The Table 3 shows the statistical distribution of keyword occurrences on metadata and information resource management. It describes the keyword-plus and authors keywords used globally while addressing and reporting or publishing articles on the focus subject. Such keywords are related to the published document as it reveals the nature of the article and emphasizes on the relevance of the articles to public advancement. It is also important to note that the various keywords used are embedded in the three categories of metadata which include Structural metadata, Descriptive metadata and Administrative metadata. According to several related investigators, all metadata studies were conducted based on the categories itemized which are divided into various classes (Chapple, 2020; Umar, 2018; Dashrath, 2014; Laxmaiah & Govardhan, 2013).

Seven hundred and sixty-nine occurrence of authors keywords were observed for the term ‘Metadata analysis’ (with index of 8.96), while the keyword-plus occurred in three hundred and eight-six articles (with index of 2.53). Other authors keywords that occurred were individual patient data, individual participant data, health-related data, network and internet connectivity data, meta-learning, meta-regression etc. On the keyword-plus, applied words that occurred were disease, therapy, management, efficacy, models, priority journals, female, male,

humans, outcomes etc, with their various percentage indexes as sown in Table 3. Such occurrences and percentage index indicates that the term metadata in information and resources management has been applied and the need to continue its application in non-complying region is imminent.

Table 3: Statistical distribution of keyword occurrences on metadata and information resource management

Keywords plus	Occurrences	% of 15277	Authors keywords	Occurrences	%of 8585
Article	386	2.53	Metadata analysis	769	8.96
Human	372	2.44	Systematic review	92	1.07
Humans	325	2.13	Individual patient data	60	0.70
Meta analysis	239	1.56	Individual participant data	44	0.51
Risk	218	1.43	Mortality	41	0.48
Female	175	1.15	Stroke	36	0.42
Systematic review	163	1.07	Network meta-analysis	34	0.40
Adult	139	0.91	Epidemiology	33	0.38
Mortality	137	0.90	Heterogeneity	33	0.38
Priority journal	131	0.86	Prognosis	32	0.37
Male	126	0.82	Cloud computing	30	0.35
Models	124	0.81	Cancer	28	0.33
Double-blind	120	0.79	Depression	28	0.33
Association	119	0.78	Machine learning	27	0.31
Efficacy	117	0.77	Meta-learning	26	0.30
Outcomes	115	0.75	Meta-regression	26	0.30
Management	108	0.71	Survival	26	0.30
Meta-analysis	108	0.71	Analysis	25	0.29
Therapy	105	0.69	Individual	24	0.28
Disease	100	0.65	Individual patient data meta-analysis	24	0.28

The Table 3 shows a statistical representation of relevant keywords plus based on the conceptual structure of growing theme on metadata and information resource management.

4. Limitation of the Study

The study is limited only to the structure, usage, usefulness and application of metadata, potential challenges in the digital age and relevance of metadata in resource information management especially as it applies to Library and information science. It does not include the usage of the term metadata, application and relevance of metadata in other science discipline as such extended focus may excessively blow the study out of proportion.

5. Conclusion

Information resources most especially in libraries are regarded as relevant and useful to users when there is proper management of the resources to create accessibility and usage. This is tailored toward actualizing the aim of the library of achieving the needs of users. In order words, the aim of the library can be met if users are satisfied with the library as an organisation.

Though observation has shown that there exists a bloom in information online in this era of information explosion that are not properly organized and as such it becomes difficult to access and used these resources. The use of manual methods in managing resources in this era has proven low in consistency and compliance and therefore requires a more sophisticated way in other to be able to cover up the loop holes created by the manual ways of organizing information resources. In order to salvage the situation of lack of proper organisation of resources, the study of metadata and resource management in this digital age becomes a necessity. It is a way to ensure that information resources can only be properly organized and be useful. The bibliometric assessment further affirmed that there is low application, consistency and compliance in metadata digitization as a low collaboration index was observed with a yearly increase in the numbers of publication. It was further affirmed by the high authors keywords and keywords-plus occurrences which holistically align with the categories and class of metadata in information and resource management. This indicates that the implementation and application of the term yet remain low. A lucid drive towards the appropriate application and implementation of the term "metadata digitizing" as a tool in library resource management in the digital era is suggestive. In addition, it has been revealed that there exist some demerits/challenges, however the benefits seems to outweigh the challenges. Hence, the need for policy on a regulatory application and appropriate implementation of digitized metadata in information resource management system cannot be overemphasized in the digital era.

Consent for publication

The author has read and agreed to the final copy of the findings as contained in the manuscript.

Competing interests

The author declared that there are no conflicting interests.

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Conflict of Interest

No conflict of interest declared.

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