

A Bibliometric Analysis of the Trends and Themes of Using Institutional Repositories to Manage Research Data

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Abstract

This paper explored a trend analysis related to Institutional Repository research from 2000 until October 2023. This research aims to determine: (1) the present publication trends and evolvement in the institutional repository's management of research data; (2) the most effective authors and institutions in the institutional repository's management of research data; (3) the most cited papers on institutional repository research data management; and (4) the major keywords and subjects related to the institutional repository's management of research data. The data was obtained through the Scopus database with the keywords institutional AND repository*OR open AND access OR scholarly AND communication OR digital AND library* OR research AND management. For analysis purposes, the selected year is 2000 to 2023. The search resulted in 309 documents and became 285 documents after screening. The data has been exported and analyzed using tools such as VOSviewer, Publish or Perish (PoP) and Microsoft Excel. The results showed that most publications were in 2018, 2019 and 2020. The most significant contributors that published the most research documents were Doctor, G. and Ifijeh, G by the author (4 publications), Universitat de Barcelona by Institution (5 publications), English by language (97,5%), United States of America by country (64,04%), Journal of Library Philosophy and Practice by titles (22 publications). This study found the article "evolving academic library specialties" written by Cox and Corral as the most cited publication. Moreover, based on the results of network visualization mapping, study on research data on institutional repository was divided into six main themes: managing research data; development Institutional Repository in developing country; implementation of user education program towards Institutional Repository; developed digital library using institutional repository; user behaviour towards Institutional Repository; essential of the Institutional Repository towards institutions and society. This

study recommended a study towards user acceptance and self-archiving for Malaysian polytechnic Institutional Repository for further studies.

Keywords: Bibliometric Analysis, Research Data, Institutional Repository, Scopus

Introduction

Information management in the Internet era has taken on a new dimension as a consequence to the institutional repository philosophy. Resource creation, distribution, and use may be redefined with the introduction of an Institutional Repository. Crow (2002), defined institutional repositories as digital collections that gather and maintain the knowledge assets of a single university or system of universities. Crow's analysis also addresses two important challenges confronting academic institutions: the librarian's role in material and knowledge management, as well as issues such as copyright, metadata, limitation, guidelines, training and workshops, and marketing.

Crow also stated that institutionally specified, academic, cumulative, everlasting, open, and interoperable content should be considered Institutional Repository content criteria. And, Johnson (2002) voiced in a particularly specific description that a digital archive of intellectual property generated by an institution's educators, researchers, and students is available to end users within and outside the institution and contains minimal barriers to access. Meanwhile Kashimura (2007) defines an institutional repository as a method for safely and reliably digitizing archived cultural material in order to preserve it. Open source software solutions have been used to create a number of institutional repositories across the globe.

Globally, Institutional Repository has grown and established. Many educational institutions choose Institutional Repository to protect the intellectual properties especially their research information. More than 6,200 Institutional Repository from around the world are registered in the portal until July 2023. Various major Institutional Repository platforms, such as EPrints, Fedora, Greenstones and DSpace, are used. DSpace and EPrints are the most widely used platforms (M. M. Rahman & Mezbah-Ul-Islam, 2014; Loan, 2014; Gurikar & S.Hadagali, 2021; Priyadashani, 2019).

The necessity of Institutional Repository to higher educational institutions in managing intellectual or research data is essential (Shinde & Kulkarni, 2023). Yet, there is still lacking in research conducted in the areas of trends analysis for the Institutional Repository's research data management. Providing accurate metadata has emerged as an essential element in which ensures that users can access and make use of reliable resources to support teaching and learning or research activities (Osman et al., 2023).

This study plotted research on Institutional Repository indexed by Scopus in order to conduct a bibliometric analysis. Bibliometric analysis defined as the expansion of institutional repository research publications from 2000 to October 2023, the productivity of institutional repository research publications by authors, institutions, countries, and source titles, highly cited documents, and the network and overlay visualization of institutional repository studies based on author keywords are some of the analyses performed out in this study.

The research questions (RQs) this study attempts to answer are as follows: RQ1: What are the patterns and current situation of institutional repositories? RQ2: Who are the most effective authors and institutions in the institutional repository's management of research data? RQ3: Which documents the most cited papers on institutional repository research data management? RQ4: What are the the major keywords and subjects related to the institutional repository's management of research data?

Literature Review

Theoretical Overview of Institutional Repository and Worldwide Scenario

According to Gardner, (1990), the centralized archive of electronic materials that would be necessary in the future and that will be of interest to authors and readers. This is where the idea of an institutional repository first emerged. Future scholarly communication will be mostly dominated by open access, digital, online journals and archives that are also free to use, unrestricted by copyright or license laws. (A. N. Zainab, 2010; Suber, 2019).

As stated in Kamraninia & Abdullah (2010), the foundation for the emergence of institutional repositories in the field of knowledge management is the growing development of academia and research. This will increase the research activities of the institution's visibility. Since their introduction as a cutting-edge and alternative medium for scholarly communication, institutional repositories have drawn significant attention from academics across a wide range of fields worldwide (Ammarukleart, 2017; Priyadashani, 2019).

This realm of Institutional Repository studies is developing so quickly that information sharing and dissemination must become more transparent. The digital revolution has made the sharing of knowledge via the internet extremely accessible and affordable. Institutional repositories encourage academics to obtain free access to all existing or upcoming scholarly papers. A number of factors, including advancements in technology, an increase in research, the cost of journal subscriptions, and the question of who will be in charge of maintaining the digital journal archives (Crow, 2002; Priyadashani, 2019), increase visibility (Devakos, 2006; Loan, 2014; Priyadashani, 2019), ranking and public value (Anenene et al., 2017).

Universities and other educational institutions need to keep up a functional institutional repository in the digital age for the purpose to increase their visibility and keep their information resources available in digital format for the utilization of the university community and students in particular (Ukwoma & Okafor, 2017; Adedimeji & Adekoya, 2019). This is the justification for why many academic organizations employ institutional repositories. (Ajibade, 2022). It is imperative for universities and other educational institutions to maintain a functional institutional repository in the digital age. Increasing visibility and guaranteeing the availability of information resources are only two of the many vital functions that these repositories fulfill.

Every educational institution should have an open-access, OAI-compliant repository, as well as a policy encouraging or requiring faculty members to deposit their research findings in the repository (Suber, 2019). University libraries now often offer a wide range of data kinds for free. The rapidly advancing information technology and communication (ICT) has led to the emergence of electronic science and research (H. R. Khan & Du, 2018). Scientific information sharing and archiving have improved significantly as a result of digital information technology. All of this information can be used by students as reference materials for learning and managed through Institutional Repository

The Advancement of Studies Across Institutional Repositories

This section explained to reveal the evolution of the development of Institutional Repository studies since 2012. The results of the Institutional Repository evolutionary progress can be seen in [Table 1](#). The idea of the emergence of Institutional Repository originated from Crow, 2000. After the initial picture of Institutional Repository emerged, scholars, also agreed with the idea of Institutional Repository in the 19th century (Budapest) Based on observation and related to the topic

Table 1*Development of theme of studies*

Period	Development Theme	Discussion
2000-2010	Future prospect	Development of Institutional Repository in the future developments in technology, adherence to open scientific ideals, and a persistent emphasis on satisfying the changing requirements of researchers and the academic community.
	User awareness	Adaptation theory, affecting to use
	Visibility	Research will become more visible and impactful through institutional repositories, which will make it more discoverable, measurable, and accessible.
	Contents	By efficiently managing the content in their institutional repositories, institutions may increase the impact, visibility, and accessibility of their research results.
2011 -2023	Factor and motive	Institutional repositories are used for a variety of factors, including support for multidisciplinary research and cooperation and institutional visibility.
	Current state	Exploring of the implementation in various location around the worlds. Based on continents such as Africa, Asia, Europe and America
	Technology change	Teaching and learnings focus on electronics resources. Platform of Institutional Repository become more useful to support online learning environment
	Metadata	Standard metadata to builds good database to make sure all the contents can get access through metadata standards

As stated in Haricombe et al. (2012), three major initiatives were launched between 2000 and 2003 to advance the domestic and global dialogue on the subject of open access, which includes the Bethesda Statement (2003), the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities (2003), and the Budapest Open Access Initiative (2001).

With the emergence of Institutional Repositories, libraries are getting the chance to recreate significant resources to improve their usability for educational objectives. For educational or learning purposes, high-quality digital learning resources that meet the demands of the learner are essential (Alphonse & Mwantimwa, 2019; Garg et al., 2017). Students at higher educational institutions now have a greater need for digital educational tools due to the Internet's enhanced user accessibility, usefulness, utility, hedonic advantages, efficacy, efficiency, satisfaction, and learnability (Soohyung Joo & Lee, 2011; Soohyung Joo & Choi, 2015; Garg et al., 2017; Owusu-Ansah et al., 2018; Soohyung Joo et al., 2018; Ocran & Afful-arthur, 2021).

Since the Institutional Repository provides no cost and economical platform, educational institutions can save money on costs associated with data storage and other related expenses. Actually, the straightforward metadata standard forms the foundation of the Institutional Repository. Because of institutional repositories, the scholarly community's appetite for open-access materials—such as articles published in journals across several disciplines—has changed how information is disseminated and how people conduct searches (Lynch, 2003) and also become important data management (Zibani, 2022).

Earlier Studies

As stated by Sidek et al. (2011), the primary objectives of the institutional repository are to offer a reliable digital platform for the gathering, conservation, and sharing of academic and artistic works. In an academic setting, an institutional repository fulfills the following purposes: 1. To provide access to academic publications globally; 2. To establish a single platform for information on scholarly works; and 3. To use digital content to protect the academic legacy.

In the study by A. Abdullah et al. (2015), mentioned about the open concept and sharing research data is crucial to the implementation of institutional repositories that embrace the idea of open sharing across national boundaries. All participants' roles, including those of academics and non-academics, postgraduates and undergraduates, will be gathered by the institutional repository. All who appear to be working there can produce content for the institution, analyse the materials, and contribute. Accordingly, the performance of the intellectual infrastructure will also depend on how the academic community distributes resources. Everyone who seems to be employed there is able to contribute, analyze the materials, and create content for the organization. As a result, the way the academic community allocates resources will also affect how well the intellectual infrastructure operations. According to the same study, libraries have effectively increased their repository capacities and can now pull in substantial volumes of data or information deposits that are clearly shown to users thanks to the help of constantly advancing information technology. Several studies have been conducted on awareness and usage among instructors, staff, and students. One such study was conducted by (Sultan & Rafiq, 2021) and (Hutson et al., 2022) where they discovered the respondents knew about the existence of policies for institutional repositories. Nonetheless, the Institutional Repository's development is constrained by issues like limited resources.

Meanwhile Marín et al., (2022), demonstrated that using educational materials that are open access more frequently is influenced by both internal and external influences. Study by Babalola & Adeyeye, (2022) & Hadad & Aharony, (2022) have carried out a study on instructors' awareness and acceptance of users. According to the study, researcher supports have an impact on lecturers' intention to publish their work on open access platforms in addition to a variety of other characteristics including attitude and user acceptance variables.

In a study on the completeness, correctness, and consistency of metadata, (Osman et al., 2023) emphasized the necessity for standardized systems to guarantee high-quality metadata related to information for managing theses and dissertations. The significance of the study has been emphasized, and it offers academic libraries insightful information about how to create and describe thesis and dissertation collections.

Apart from that Amanullah & Abdullah, (2023) carry out a study related to research data management carried out by academic libraries in Malaysia. In addition, the studies conducted by (Nazim & Ashar, 2023 ; Baro & Nwabueze-Echedom, 2023 ; Clarke & Kim, 2023)

highlight the specifics of the establishment and growth of the institutional repository in research regions including Africa, Nigeria, and the United States.

Methodology

Researchers utilized the bibliometric method for a variety of purposes, including examining the intellectual structure of an area of interest in the literature, visualizing the patterns of research collaboration, and identifying a new progression in the performance of documents. Its help to monitoring the literature developments and trends (Roy & Basak, 2013) and (Demiryürek, 2023). Bibliometrics was introduced by (Pritchard, 1962) to replace the previous term "statistical bibliography." Since then, the rapid rise of knowledge has enabled bibliometric analysis to progress quickly and become increasingly refined (Tomaszewski, 2023).

In bibliometric analysis, the research data base tends to be sizable and unbiased. By carefully analyzing huge amounts of data, bibliometric analysis has been utilized to map and characterize the cumulative scientific knowledge and evolutionary nuances of an area of science. In academia and research, bibliometric analysis is frequently used to evaluate the significance of findings, pinpoint significant writers and publications, and comprehend the organization of a certain field of study. As a result, this bibliometric analysis could help to progress a scientific field. Furthermore, bibliometric analysis enables academics to generate fresh research ideas, spot holes in an area, and directly contribute to it (Donthu et al., 2021) and (Zhai et al., 2023).

Techniques for mapping, grouping, and bibliometric analysis are frequently used by researchers. Additionally, the assumptions and concepts that underlie clustering and mapping algorithms are highly dissimilar. The method demonstrates how the parameterized and weighted variants of the VOSviewer mapping methodology can be generated from the same fundamental idea. This method combines grouping and mapping the most-cited papers from a specific time period. (Effendy et al., 2021) and (Jia & Mustafa, 2023).

Data Collection

When a wide range of discipline and topic areas are included and integrated into research or academic endeavors, it is referred to as having a broad interdisciplinary scope. It entailed supporting interdisciplinary, multidisciplinary, and transdisciplinary methods to research and problem-solving while overcoming the conventional limits of certain fields of study. This approach aims to address complicated and varied issues by combining information and approaches from other disciplines, providing a more thorough and holistic understanding. In order to obtain an understanding of the pertinent content and global research activity dynamics, a wide multidisciplinary scope is necessary (Simonet, 2010) and (Suprpto et al., 2021).

It's necessary to select the right data sources and research techniques based on the bibliometric analysis's objectives and research questions. When gathering and interpreting bibliometric data, researchers should also take data quality, potential biases, and ethical considerations into account. For bibliometric analysis to be transparent and reliable, proper documentation and data management procedures are essential.

The methodology used in this study is dependent on how data was collected, filtered, and then finalized. The reliable data can then be evaluated and analyze. Researchers wish to concentrate on all Institutional Repository studies that are accessible in the Scopus database, thus researchers must first specify the topic and scope of the study, which should be based

on the purpose of the study. The Scopus database was selected due to its wide multidisciplinary scope and importance as a source for bibliometric analysis (Burnham, 2006) and (Chin & Chew, 2021). Also, several bibliometric studies in various disciplines have used data from the Scopus research database (A. M. Khan et al., 2023) and (Hadad & Aharony, 2022).

Additionally, Scopus offers the most thorough overview of international research in science, technology, medicine, socio-humanities, and the arts and is one of the biggest abstracts and citation databases in the world. (Burnham, 2006 ; Ahmi & Mohamad, 2019 & Donthu et al., 2021).

The selection of the documents for this study was made in accordance with the research methodology shown in Figure 1. The statistics were obtained from the Scopus database as of October 26, 2023. We searched the publications pertaining to Institutional Repository studies inside the title fields, abstracts, and keywords as of October 26, 2023 due to the restricted amount of Institutional Repository studies.

To achieve this, the query that follows was utilized: TITLE-ABS-KEY (institutional AND repository*OR open AND access OR scholarly AND communication OR digital AND library* OR research AND management) AND PUBYEAR>1999 AND PUBYEAR<2024

This query produced a total of (309) documents in response. After several data cleansings, no duplicate papers were found. Consequently, following the approach, the same quantity of documents was retained. Because they did not present the institutional repository as the primary topic of discussion in the context of open access and digital libraries, 24 documents were eliminated from the analysis section. Thus, 285 documents in total are still pending bibliometric analysis.

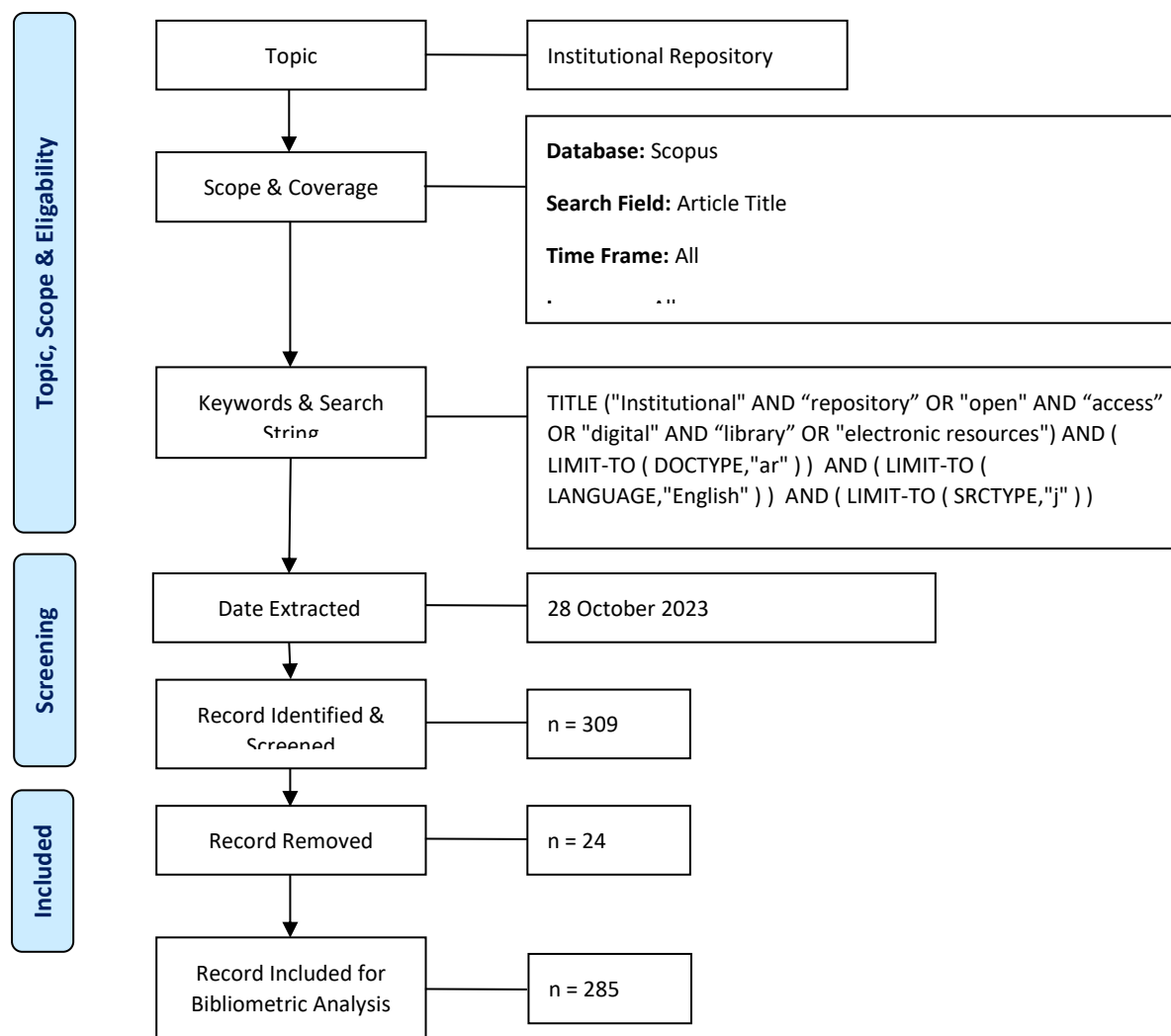


Figure 1 Flow chart of the search approach

Source: (Alam et al., 2023)

Instruments of Analysis

Following that, the data was exported as research information systems (.ris) and comma-separated values (.csv) files from the Scopus database. The following details are included in this dataset: type, year, language, subject matter, abstract, country, affiliation, citations, and authorship. The bibliometric analysis was performed out by researchers using Microsoft Excel, Publish or Perish and VOSviewer. All of these tools have been used to create bibliometric network maps and statistical studies. Bibliometric analysis is an analytical instrument for analyzing academic literature, scholarly publications, and other types of written content. For the purpose to investigate the trends in publishing, authorship, citation, and collaboration within a particular field of research, statistical and mathematical tools are applied.

A well-known and freely accessible bibliometric analysis tool called "Publish or Perish" is mainly concerned with exploring the academic production and influence of scholars and institutions. Conversely, Publish or Perish gathers and examines academic citations. The application is frequently used to compute bibliometric metrics like the h-index, citation

counts, and other metrics that are crucial for assessing an academic's contributions to their area. It compiles and examines unprocessed citations from several sources, presenting a range of citation metrics including the quantity of papers, total citations, and h-index (Harzing.com, n.d.) and (Trau, 2012) .

A text-mining capability performed by VOSviewer allowed users to see connections between citations in published articles. The published map would be displayed in various ways and have various capabilities, such as system zoom, searching, and scrolling, making it more detailed (Susanti et al., 2022). The data would be turned into a networked map via VOSviewer (Al Husaeni & Nandiyanto, 2022). VOSviewer graphically depicts the node network, including the quantity and overall strength of connections. The size of the network and the interlinking lines that connect it represent the importance and strength of the linkages.

The positive aspect of VOSviewer is that it analyzes co-citation data and co-occurrence networks using integrated clustering and mapping techniques while text mining functions are used to find relevant noun phrase combinations. VOSviewer is frequently used in the field of scientometrics to evaluate and visualize scientific literature and collaboration networks. There are benefits to VOSviewer's visualization as well (Effendy et al., 2021).

A network visualization map shows the VOSviewer as items, lines, and colors. Everything that weigh more will stand out more than things that weigh less. Labels serve as representations of the real items, which are by default circled. The circle's size and the item's label depend on the weight of the object. The likelihood of forgetting the item's label and circle increases with item weight. Several clusters are created by VOSviewer using the visualization results. Each cluster can be identified by its color and the color of an item is determined by the cluster. Links are denoted by lines connecting objects (van Eck & Waltman, 2023)

Results And Discussion

To determine how to address the research questions formulated in the previous section, the analysis of this paper used the following scholarly work characteristics: publication by year, document types, publication by source title, source types, publication by country, publication by institutions, languages of documents, subject area, citation patterns, and themes in Institutional Repository studies based on keywords and title and abstract.

Most of the information is provided as frequency and percentage. Some of the research or articles have taken into consideration the total number of citations (TC), the average number of citations per publication (C/P), and the average number of citations per cited publication (C/CP).

A Review of the Current Issue of Institutional Repository Studies Publications

To answer RQ1: (What are the patterns and current situation of institutional repositories?), researchers examined the publication trend in the Institutional Repository studies using total publications by year, language, document type, source type and subject area. Figure 2 shows the development of journal publications each year. It could be observed that from 1997 to 2023, the highest number of publications on Scopus occurred in 2013 and with 25 research publications. The number of research publications is in a state of ups and downs throughout the period from 2000 to 2013. However, the number of publications remains consistent at more than 10 publications starting in 2012 until 2023 during the current decade. Figure 2 also shows that during the first 12 years, the number of publications on

Institutional Repository was minimal. The first publication about Institutional Repository was written by Burchill et al 2000 in a journal entitled “Journal of Medical Internet Research. The tiles of the articles are organizing the present, looking to the future: An online knowledge repository to facilitate collaboration

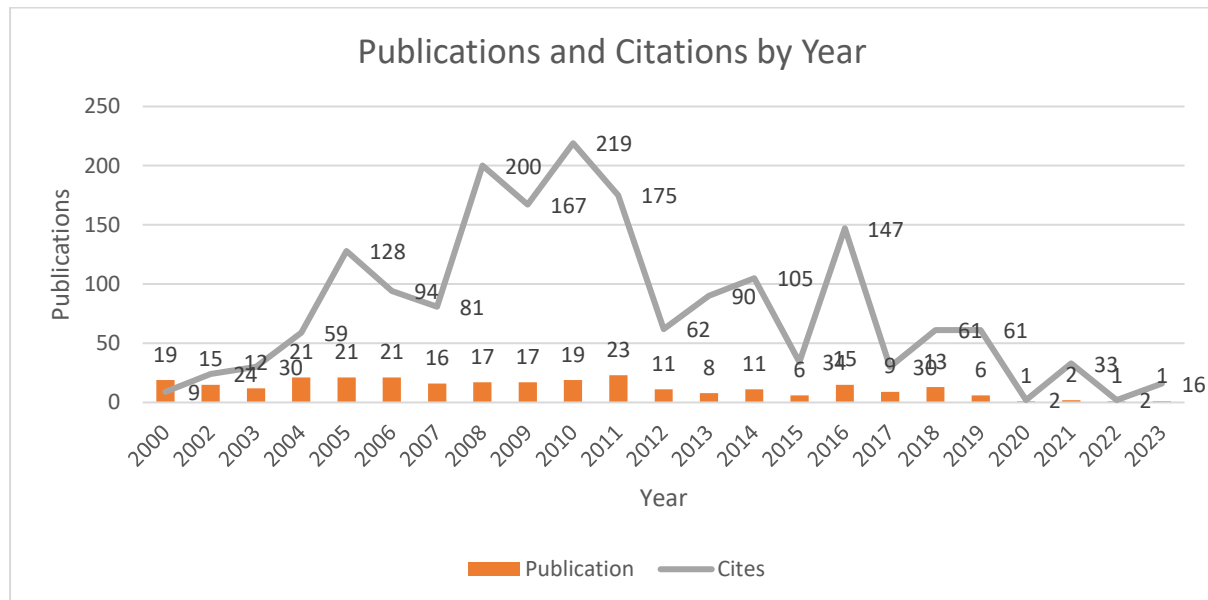


Figure 2 : Trends and impact of the publication by year

There has not been much progress in the number of Institutional Repository publications in the first decade. However, since 2013 the number of publications has increased dramatically. Table 2 shows the performance of citations from documents that discuss about Institutional Repository. The growth of citations of document publications has a positive relationship with the number of documents. The most significant number of citations was generated by publications in 2014, with 219 citations, followed by publications in 2016, with 200 citations. For the last three years, the studies about Institutional Repository look like decreased from 21 publications for the year 2020, decreased to 12 publications in the year 2021 and increase to 15 publications in the year 2022

Table 2*Publications by Year*

Year	Publications	Citation	Number of Cited Paper	Citation Per Paper	Citation Per Year	Citable Years
2023	19	9	3	3.00	9.00	1
2022	15	24	6	4.00	24.00	1
2021	12	30	7	4.29	15.00	2
2020	21	59	14	4.21	19.67	3
2019	21	128	14	9.14	32.00	4
2018	21	94	17	5.53	18.80	5
2017	16	81	9	9.00	13.50	6
2016	17	200	15	11.76	28.57	7
2015	17	167	14	11.93	20.88	8
2014	19	219	18	12.17	24.33	9
2013	23	175	11	15.91	17.50	10
2012	11	62	11	5.64	5.64	11
2011	8	90	8	11.25	7.50	12
2010	11	105	10	10.50	8.08	13
2009	6	34	5	6.80	2.43	14
2008	15	147	13	11.31	9.80	15
2007	9	30	7	4.29	1.88	16
2006	13	61	10	6.10	3.59	17
2005	6	61	5	12.20	3.39	18
2004	1	2	1	2.00	0.11	19
2003	2	33	2	16.50	1.65	20
2002	1	2	1	2.00	0.10	21
2000	1	16	1	16.00	0.70	23

Table 2 shows the performance of citations from documents that discuss Institutional Repository studies. There is uncertainty in the number of publications and citations which shows a trend of up and down. From 2013 to 2023 shows a trend of more than 15 publications compared to previous years. Based on observations, citations also show a fluctuating trend, of which the number of citations exceeding 100 was in 2008 with 147 citations. While there was a consistent increase over 100 citations in 2013 to 2016 before decreasing again in 2018. The growth of citations of document publications has a positive relationship with the number of documents. The most significant number of citations was generated by publications in 2014, with 219 citations, followed by publications in 2016, with 200 citations.

Table 3 :*Publications by Languages*

Country	Total Publications	Percentage
English	266	93.33
Portuguese	8	0.0281
Spanish	4	0.0140
Germany	2	0.0070
Chinese	2	0.0070
Turkish	1	0.0035
French	1	0.0035
Catalan	1	0.0035
	285	

A developmental portrait of Institutional Repository studies from the language side in Table 3 shows that English dominates the number of publications with 266 documents. From the table, the research on managing research data in Institutional Repository has also been published in other languages, such as Portuguese, Spanish, Germany, Turkish, Chinese, French and Catalan. There is also research carried out in other languages such as Portuguese and Spanish. Nevertheless, the English language has a great influence for research related to Institutional Repository as stated in Table 3.

Table 4*Publications by Document type*

Document Type	Number of Documents	Percentage
Articles	187	65.73
Conference Paper	53	18.53
Review	17	5.94
Book Chapter	14	4.90
Conference Review	11	3.85
Books	2	0.70
Note	1	0.35
	285	

Table 4 compares the number of publications about Institutional Repository studies based on the document type. The articles is the dominant type of document compared to other documents, such as conference papers and book chapters, representing 65.73% of publications in Institutional Repository. For conference papers with 53 documents, review with 17 documents, books chapter with 14 documents, conferences review 11 documents, books with 3 documents and note only 1 document. This is show that, authors or scholars more prefer to do a writing to published in the journals. Journals frequently concentrate on a narrow range of subjects or fields. Writers select journals that correspond with the topic and emphasis of their investigations.

Table 5 :*Publications by Source Type*

Source Title	Number of Publication	Percentage
Journal	206	72.28
Books	16	6.0
Conferences proceeding	64	22.0
	285	

As shown in Table 5, the development of Institutional Repository is published in the various journals, with 82.6% of total publications followed by books with 16 (0.06%) publications, and conference proceedings with 64 (0.22%) publications.

Table 6*Publication by subject area*

SUBJECT AREA	Number of Publication	Percentage
Social Sciences	221	44.47
Computer Science	121	24.35
Arts and Humanities	34	6.84
Engineering	23	4.63
Medicine	18	3.62
Business, Management and Accounting	15	3.02
Decision Sciences	15	3.02
Mathematics	15	3.02
Environmental Science	6	1.21
Earth and Planetary Sciences	5	1.01
Economics, Econometrics and Finance	4	0.80
Nursing	4	0.80
Biochemistry, Genetics and Molecular Biology	3	0.60
Agricultural and Biological Sciences	2	0.40
Immunology and Microbiology	2	0.40
Multidisciplinary	2	0.40
Physics and Astronomy	2	0.40
Energy	1	0.20
Health Professions	1	0.01
Materials Science	1	0.01
Pharmacology, Toxicology and Pharmaceutics	1	0.01
Veterinary	1	0.01

Based on Table 6, publications on Institutional Repository were published predominantly in the journals categorized in Social Sciences with 221 documents, Computer Science with 121 documents, and followed by Arts and Humanities with 34 documents. The others subject area such as business with 23 documents, engineering with 23 documents,

management and medicine with 18 documents. The rest subject below than 10 documents for each of them such as Environmental Science, Earth and Planetary Science and others.

Most Active Contributors

In order to answer RQ2 (Who are the most effective authors and institutions in the institutional repository's management of research data?), this section presents the statistic of the publication by authors, institutions, countries and source titles

Publications by Most Contributed Authors

Table 7

Most contributes authors

Authors	Affiliation	Country	Papers	Citations	Cites_Year	Cites_Paper	h_index	g_index
Doctor, G.	ICFAI Business School, Ahmedabad	India	4	30	2	7.5	2	4
Ifijeh, G.	British Canadian University,	Nigeria	4	15	2.14	3.75	2	3
Lopez-Borrull, A.	Universitat Oberta de Catalunya,	Spain	3	17	2.43	5.67	2	3
Sabharwal, A.	University of Toledo	USA	3	11	1.57	3.67	2	3

As depicted in Table 7, from the observation period, Doctor, G and Ifijeh, G. was the author who published the most research documents on research data in Institutional Repository on Scopus, with four publications. Followed by Lopez-Borrull, A. and Sabharwal, A with three publications. In term of citations, Doctor G. has more citations documents compares with others with 30 citations followed by Lopez-Borrull, A with 17 citations, Ifijeh, G. with 15 citations and Sabharwal, A. with 11 citations. This indicates that dominant writers perceive a certain deficiency in academic writing related to institutional repositories.

Publications by Sources Titles

Table 8*Publication by source titles (CY: cites per year, CP: cites per paper)*

No	Journal	Papers	Citations	Years	CY	CP	h_index	g_index
1	Cataloging and Classification	3	9	14	0.64	3	2	3
2	Ciencia de Informato	4	0	4	0	0	0	0
3	DESIDOC Journal of Library and Information Technology	3	19	11	1.73	6.33	2	3
4	Library Management	4	29	18	1.61	7.25	3	4
5	Library Philosophy and Practice	12	26	9	2.89	2.17	3	4
6	Library Review	4	61	15	4.07	15.25	4	4
7	Journal of Librarianship and Scholarly Communication	3	4	4	1	1.33	1	2
8	Library Hi Tech	7	127	17	7.47	18.14	7	7
9	Malaysian Journal of Library and Information Science	3	5	2	2.5	1.67	2	2
10	Journal of Medical Library Association	3	10	9	1.11	3.33	2	3
11	OCLC Systems and Services	4	32	16	2	8	3	4
12	Journal of Academic Librarianship	3	34	9	3.78	11.33	1	3
13	Electronic Library	7	92	12	7.67	13.14	5	7
14	Serial Librarians	5	32	9	3.56	6.4	4	5
15	Serial Review	6	58	14	4.14	9.67	4	6

Based on source titles, Institutional Repository studies are displayed in Table 8. Fifteen source titles that have produced Institutional Repository studies publications of more than three documents are listed in Table 8. The most published source title is Library Philosophy and Practice. The Journal of Library Philosophy and Practice released twelve papers. The following positions were filled by the Library Hi Tech and Electronic Library with seven documents apiece, followed by Serial Review with six, Serial Librarians with five, and OCLC Systems and Services, Ciencia de Informato, Library Management, and Library Review with four documents.

Publications by Institutions**Table 9***Publication By Institutions That Published More Than Three Papers*

No	Affiliation	Papers	Citations	Cites_Year	Cites_Paper
1	Universität de Barcelona	5	33	4.71	6.6
2	University of Oxford	4	34	2	8.5
3	Covenant University	4	15	2.14	3.75
4	Fundacao Oswaldo Cruz	4	11	1	2.75
5	University Malaya	4	6	3	1.5
6	University of South Africa	4	38	4.75	9.5
7	Indiana University-Purdue University Indianapolis	4	40	2.22	10

Table 9 shows an overview of the institution's distribution of publications in Institutional Repository studies. Universität de Barcelona was ranked first with five publications with 33 number of citations. The second and onward level is attached to University of Oxford with four papers (34 citations) and followed by Covenants University four papers (15 citations). The rest institution is Fundacao Oswaldo Cruz, four papers (11 citations), University Malaya; four papers (6 citations), University of South Africa; four papers (39 citations) and Indiana University – Purdue University Indianapolis; four papers (40 citations). The thing that can explain this phenomenon is that Universität de Barcelona most active institutions with publications under these topics. And the only university in Malaysia among tops five institution with most publications is University Malaya compare to other South East Asian countries.

Publications by Country.**Table 10***Publications by top 20 countries*

Ranking	Country	Documents	%
1	United States	97	31.39%
2	India	23	7.44%
3	United Kingdom	20	6.47%
4	Brazil	16	5.18%
5	Germany	13	4.21%
6	Italy	13	4.21%
7	Nigeria	13	4.21%
8	Spain	13	4.21%
9	Canada	11	3.56%
10	Australia	10	3.24%
11	South Africa	9	2.91%
12	China	6	1.94%
13	France	6	1.94%
14	Colombia	5	1.62%
15	Malaysia	5	1.62%
16	Ghana	4	1.29%
17	Greece	4	1.29%
18	Argentina	3	0.97%
19	Bangladesh	3	0.97%
20	Belgium	3	0.97%

Apart from the year, all documents related to Institutional Repository were also analyzed based on the country the authors are affiliated with (see Table 9). In Table 10, the top 20 of the defined countries that published documents in Institutional Repository on Scopus were analyzed. The dominance of research related to Institutional Repository was carried out in United States, representing 97 (31.39 %), with a total of 97 documents published, followed by India with 23 documents, United Kingdom with 20 documents, Brazil with 15 documents. Followed by Germany, Italy, Spain and Nigeria with 13 documents. For Malaysia its 15th position with 5 documents in Scopus within 2000 until 2023.

Most Cited Documents

This section will answer RQ3 (Which documents the most cited papers on institutional repository research data management?). Citation analysis is a significant bibliometrics tool because it gives a quantitative means to assess the academic influence of research and comprehend the dynamics of scientific communication and collaboration. It can be utilized by organizations, scholars, and decision-makers to make educated choices on research funding, publication tactics, and academic evaluation. Typically, the number of citations each paper was used to determine the relative effect on the overall field (Tomaszewski, 2023) and the

number of times an article is cited by all of the database's documents is displayed in a citation. (Tian et al., 2008).

According to Teplitkiy et al., (2022), consequently, the most widely cited articles influence the research frontier considerably more than their simple citation counts suggest. Higher citation counts encourage readers to engage in deeper ways. The Scopus database was used to get the number of citations, which was then extracted using Mendeley into a research information system (.ris) format and examined using the Publish or Perish (PoP) program.

Table 11

Most Cited Documents

No	Authors	Title	Cites	Cites per Year	Age
1	A.M. Cox, S. Corral (2013)	Evolving academic library specialties	71	7.1	10
2	McGuinness & Fulton (2019)	Digital literacy in higher education: A case study of student engagement with e-tutorials using blended learning	56	14	4
3	Fuller et., al., (2014)	Achieving Open Access to Conservation Science	44	4.89	9
4	S. Pinfield (2015)	Making Open Access work: The "state-of-the-art" in providing Open Access to scholarly literature	43	5.38	8
5	A.H. Poole (2015)	How has your science data grown? Digital curation and the human factor: a critical literature review	39	4.88	8
6	J. Cho (2014)	Intellectual structure of the institutional repository field: A co-word analysis	39	4.33	9
7	P. Jain (2011)	New trends and future applications/directions of institutional repositories in academic institutions	38	3.17	12
8	Palmer et., al., (2008)	Strategies for institutional repository development: A case study of three evolving initiatives	38	2.53	15
9	Diekema et., al., (2014)	The NSF/NIH Effect: Surveying the Effect of Data Management Requirements on Faculty, Sponsored Programs, and Institutional Repositories	33	3.67	9
10	S.-H. Chang (2003)	Institutional repositories: the library's new role	32	1.6	20
11	F.A. Loan, S. Sheikh (2016)	Analytical study of open access health and medical repositories	30	4.29	7
12	Jenkins et al, (2005)	Content in, content out: The dual roles of the reference librarian in institutional repositories	30	1.67	18
13	Ezema, (2013)	Local contents and the development of open access institutional repositories in Nigeria University libraries: Challenges, strategies and scholarly implications	29	2.9	10
14	Yu, H.H. (2017)	The role of academic libraries in research data service (RDS) provision Opportunities and challenges	27	4.5	6

15	Schopfel et al., 2014	Open access to research data in electronic theses and dissertations: An overview	27	3	9
16	Xia & Opperman, (2010)	Current Trends in Institutional Repositories for Institutions Offering Master's and Baccalaureate Degrees	27	2.08	13
17	Cassella & Morando, (2012)	Fostering new roles for librarians: Skills set for repository managers - results of a Survey in Italy	25	2.27	11
18	Devarakonda et. al., 2011	Data sharing and retrieval using OAI-PMH	25	2.08	12
19	F.J. Manion et. al., 2009	Security and privacy requirements for a multi-institutional cancer research data grid: An interview-based study	25	1.79	14
20	Dlamini & Snyman, (2017)	Institutional repositories in Africa: obstacles and challenges	24	4	6

The number of citations was obtained from the Scopus database, then extracted through Mendeley into a research information system (.ris) format, and then analyzed using the Publish or Perish (PoP) application. Table 11 illustrated that a full 20 documents in Institutional Repository studies had more than 23 citations. The most cited document was "Evolving academic library specialties" Cox & Corral (2013) in the Journal of the American Society for Information Science and Technology. This article already had 71 total citations and 7.1 citations per year. Cox & Corral (2013) discussed the challenging role of a librarian not only as a manager of an organization but also facing challenges as an information manager such as institutional repository manager, research and data manager, systems librarian, electronic resources librarian and digital librarians.

Meanwhile, McGuinness & Fulton (2019) discussed study highlights factors which positively and negatively affect user engagement with digital learning objects and explores students' perceptions of the role of online learning within their academic programs. Finding of the study was students' responses with positive responses with system accessibility, ease to use, design and duration of e-tutor were effective. They also expressed enjoyments with that learning facility. However, there are some negative response with internet connection issues given problem towards the learning process.

Fuller et., al., (2014) discussed about the role of open access for the benefit of institutions that will help boost university research. The free Research4Life database has helped researchers as opposed to paid databases that burden researchers and institutions in general. To ensure that, this research4Life database is viable, contributors have been encouraged to contribute funds such as membership fees.

Themes in Institutional Repository

To answer RQ4 (What are the the major keywords and subjects related to the institutional repository's management of research data?). The network and overlay representations of the author's keywords were built after the authors investigated the frequency. On the basis of the title and abstract of the downloaded publications, the authors also presented the term occurrence networks at the same time.

Author's Keyword Analysis

Author keywords are unquestionably important for academics looking for research trends. Keywords and subjects from the authors are excellent resources for staying current and connected in their fields of study. Author keywords analysis in bibliometrics assists scholars and institutions in understanding an author's research emphasis and contribution to their field. Additionally, (Lu et al., 2021) and (Agbo et al., 2021), stated that author keyword analysis is crucial for determining the development of research themes such as latest development, identifying research gaps and future direction of the research.

There are 160 types of keywords used in Institutional Repository studies publications. The study indicates (see Table 12) the top ten's most active author keywords in the Institutional Repository studies based on more than 25 times frequency. Institutional Repositories became the most dominating keyword of Institutional Repository publications, followed by the open access with 69 (43.13%), digital libraries with 53 (33.13%), information services with 43 (26.88%), information management and scholarly communication with 37 (23.13%), metadata with 32 (20%), human with 31 (19.38%), institutional repository with 30 (18.75%) and societies and institutions with 26 (19.38%)

Table 12*Ten most author keywords*

No	KEYWORD	Frequency	%
1	Institutional Repositories	75	46.88
2	Open Access	69	43.13
3	Digital Libraries	53	33.13
4	Information Services	43	26.88
5	Information Management	37	23.13
6	Scholarly Communication	37	23.13
7	Metadata	32	20.00
8	Human	31	19.38
9	Institutional Repository	30	18.75
10	Societies and Institutions	26	16.25
Total	160		

The network representation of the most often used author keywords in co-occurrence research from institutional repositories is displayed in Figure 3. A five-keyword criterion was applied to the 285 documents included in the sample. Of the 720 keywords used by the authors, 29 have satisfied the requirements. (/) The study utilized VOSviewer for mapping analysis in order to analyze keywords. Figure 3 illustrates how the VOSviewer software maps the visual appearance of these words together. In this visualization network, the node itself depicts a term or concept, while the distance between nodes represents the relationship between phrases or concepts (Sedighi, 2016) and (Zhai et al., 2023)

In this diagram, each color shows a cluster. This visualization map will include six groups, each representing one of six topics. These clusters can be categorized into six themes: Theme 1: managing research data (red—19 items), Theme 2: Development Institutional Repository in developing country (green—16 items), Theme 3: Implementation of user education program towards Institutional Repository (blue—15 items), Theme 4: Developed digital library using institutional repository (yellow—12 items), Theme 5: User behaviour

towards Institutional Repository (purple – 8 items and Theme 6: Essential of the Institutional Repository towards institutions and society (light blue – 4 items)

Table 13 shown the theme in the publications of research data in Institutional Repository. The first theme is managing research. The first theme is managing research data using Institutional Repository platform. This theme is aimed at various forms of management from the aspect of curation, sharing of research data. Various data management methods that can benefit users. The second theme is discussion on the development of Institutional Repositories in developing countries. In this visual it is clearly shown that the country of Nigeria is often highlighted. Educational institutions in developing nations may find it advantageous to use open-source repository platforms such as DSpace, EPrints, or Open Repository, especially when budgetary constraints are present. among the studies related to the implementation of institutional repository in developing countries (Rafiq, 2022) and (Johnson Adetunji Adeyemi et al., 2017).

The third theme implementation of user education program towards Institutional Repository. In order to assure that researchers, staff, students, and other stakeholders use the Institutional Repository efficiently, a user education program must be put in place. According to (Zha et al., 2015), librarians should try their best to provide diversified user training so as to guide potential users to seek information in digital libraries. This will raise the visibility of research outputs and promote an environment that values cooperation and open access. The fourth theme rise in this articles is developed digital library using institutional repository where it was essential part of the ecosystem for scholarly communication are institutional repositories, which offer a centralized location for organizing, preserving, and sharing digital content created by the staff, researchers, and students at the institution. (Chaudhari & Patel, 2019) stated that, Institutional Repository is able to play a role in delivering digital services to users due to features such as managing, searches able and retrieval contents.

Theme number five is focusing on user behaviour towards Institutional Repository. To continue to meet the needs and expectations of its users, it is important to optimize an Institutional Repository's design, functionality, and content. User behavior in the context of an Institutional Repository can be diverse, encompassing various interactions such as content deposition, searching, downloading, and feature engagement. According to (Lagzian et al., 2015), library users is one of the part critical factors the successfulness of implementation of Institutional Repository. Final theme or theme number six is essential of the Institutional Repository towards institutions and society. Basically, Institutional Repository are essential for knowledge advancement, teamwork, and the intellectual and societal influence of academic institutions. Their open-access design complies with knowledge-sharing best practices and advances education, research, and societal welfare as a whole. According to Bashir et al., (2021) educational institutions all around the world will embrace this green route to open access because a university's research standing and influence are highly connected with the content mounted via an Institutional Repository.



Figure 3 Author keywords visualization

Table 13

Research Themes In Institutional Repository Based On The Author’s Keywords

Keywords	Clusters	Occurrences	Total link strength	Themes
Data curation	1	5	17	Theme 1: Managing research data
data management	1	12	43	
Data repositories	1	5	25	
data sharing	1	7	32	
Digital collections	1	6	15	
Digital curation	1	5	21	
Digital preservation	1	6	15	
Information management	1	34	196	
Life cycle	1	8	57	
Open data	1	7	39	
Open science	1	9	35	

Open access	1	5	23	
Project management	1	6	16	
Research data	1	10	56	
Research data management	1	12	53	
Research data managements	1	5	40	
scholarly communications	1	7	20	
Search engine	1	5	35	
Academic institutions	2	6	40	Theme 2: Developm ent Institution al Repository in developing country
Academic libraries	2	20	79	
Archive management	2	19	8	
Content management	2	5	18	
Design, methodology, approach	2	7	44	
Developing countries	2	6	44	
Digital archive	2	6	30	
Digital libraries	2	52	251	
Digital resources	2	5	21	
Digital storage	2	21	82	
Institutional repositories	2	74	346	
Libraries	2	19	102	
Nigeria	2	7	23	
Scholarly communication	2	36	131	
Universities	2	6	25	
University libraries	2	10	37	
Adult	3	5	37	Theme 3: Implement ation of user education program towards Institution al Repository
Article	3	16	105	
Communication	3	6	12	
Female	3	7	48	
Grey literature	3	5	29	
Human	3	21	129	
Humans	3	10	68	
Information dissemination	3	6	25	
Information retrieval	3	7	51	
Internet	3	5	31	
Librarian	3	6	43	
Library	3	12	92	
Male	3	8	52	
Organization and management	3	7	48	
Publishing	3	14	88	
	15			
Data mining	4	6	6	Theme 4: Developed
Digital repositories	4	10	32	

Digital repository	4	10	50	digital library using institutional repository
Electronic document exchange	4	5	25	
Information services	4	41	273	
Information systems	4	6	41	
Interoperability	4	7	38	
Knowledge management	4	12	63	
Metadata	4	31	171	
Open access	4	67	252	
Scientific communication	4	6	32	
e-learning	5	5	24	Theme 5: User behaviour towards Institutional Repository
Education	5	11	52	
Higher education	5	5	13	
Open sources software	5	10	46	
Open system	5	9	55	
Research	5			
Students	5	6	35	
Surveys	5	7	57	
Digital library	6	7	17	Theme 6: Essential of the Institutional Repository towards institutions and society
DSpace	6	5	16	
Institutional repository	6	30	110	
Societies and institutional	6	24	159	

Term Analysis.

Term analysis is an effective bibliometrics approach that helps academics analyze research trends, evaluate the structure and substance of academic literature, and decide on future research directions and collaborative prospects. It offers quantitative analysis to support qualitative evaluations of scholarly work. The relatedness publications are shown in Figure 4 according to abstract co-occurrence terms and title. This visualization shows the crucial terms in a group of articles as well as the co-occurrence of linkages between them. In data visualization, clustering is used to find and emphasize underlying structures in the data that might help with comprehension, analysis, and decision-making. The foundation of clustering is the idea that objects inside the same cluster represent similar subjects (Nobanee et al., 2021). In this study, text analysis is also used to the appearance of publication titles and a mix of titles and abstracts from documents retrieved from the Scopus database (Ahmi & Mohd Nasir, 2019) and (Kushairi & Ahmi, 2021).

Nodes that had been grouped by cluster were used to represent items. Every cluster featured a distinct hue. The above image demonstrated that the research development was

separated into three clusters, with the larger the node size indicating greater criticality. The network visualization results showed at least three critical items with the most significant nodes: Institutional Repository, issue, and efficiency. A more detailed explanation for each cluster is as follows:

Issue in Managing Research Data

After being connected, it turned out that research that discussed Institutional Repository was related to several things such as managing the digital contents, creating and increasing the awareness through user educations, the challenging and the barriers and development of the platforms around the worlds.

The discussion of the issue related to the words article is Institutional Repository, e-learning, digital content services, digital library, development of the institutional repository and openness of the data or scientific information. There are various issues related to research data management Amanullah & Abrizah, (2023), development of the Institutional repository in India (Nagpal & Radhakrishnan, 2022) and Africa continent (Baro & Nwabueze-Echedom, 2023) and (Ukwoma & Ngulube, 2019).

Universities or higher educations may face serious challenges in raising awareness of institutional repositories. Institutional repositories are made specifically to preserve, arrange, and make accessible the research materials and intellectual output that are created by faculty, researchers, and students at learning institution. Libraries as service provider may improve the effect and exposure of their institutional repositories, which will eventually benefit the institution and the larger research community, by addressing these awareness concerns and actively interacting with the academic community.



Figure 4 The network visualization of terms co-occurrence based on the title and abstract.

Conclusion

This article indicated that the majority of publications happened between 2006 and 2023. However, there is irregularity in the number of publications, which has surpassed ten since 2006. Then in the year 2007, it fell once more to nine publications and the increased to fifteen publications in the year 2008, six publications in the year 2009, eleven publications in the year 2010 and eight publications in the year 2011; these were fluctuating trends. Only from the year 2012 till the year 2023 did publications consistently rise by more than ten times.

Also based on its findings, the most frequent authors are Doctor G. and Ifijeh, G with both of them with four publications. Another most frequent contributors Universitat de Barcelona (five papers), United State by country with 97 papers (31.39%), Journal Library Philosophy and Practice with 12 papers and English language with 266 papers or 93.33%. The paper by A.M. Cox, S. Corral (2013) with titles "Evolving academic library specialties" was the most frequently cited related to these topics.

Prospective Opportunities for Research

There were opportunities for further research based on the research results related to the development of Institutional Repository research. The Malaysia Polytechnic Libraries provided the Institutional Repository with the chance to undertake a user acceptance and adoptions of Institutional Repository platform. To improve the Institutional Repository in information management systems, it will be opportunities to examine how users' responses to the features of the platform to support users learning process in Malaysian polytechnics.

In addition to research data management studies, efficiency studies of lecturer self-archiving need to be given greater attention and thoroughly investigated. Since lecturers are the primary providers of scholarly knowledge to the platform, efficiency becomes a crucial concern for preserving the viability of an institutional repository. At Malaysian polytechnics, the efficiency study still depends on the self-efficacy of the lecturers. Few researches have examined the significance of self-archiving in others university lecturers (Singeh et al., 2013).

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