

Electronic Theses and Dissertations (ETDs): A Scientometric Analysis of Research Publications

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Abstract

This research paper presents a comprehensive scientometric analysis of research papers published on Electronic Theses and Dissertations (ETDs) using the 'Scopus' database for the period spanning 1996 to 2023 (July) 2023. By analysing bibliographic characteristics and employing scientometric methodologies, this study presents trends and patterns in the ETD landscape. Utilizing a range of visualization tools, including the R programming language, RStudio, the Bibliometrix package, and other visualization resources, the research assesses the growth and impact of ETD publications. The dataset comprises 358 publications originating from 163 distinct sources, revealing a notable 5.27% annual growth rate and an average of 6.095 citations per document. Beyond these quantitative findings, the study explores coupling relationships, citation analysis, co-occurrence patterns, authorship dynamics, and levels of collaboration within the ETD domain. The insights from this study contribute to a deeper understanding of the evolving landscape of research on ETDs and shed light on the broader implications of scholarly communication in the digital age.

Keywords: Academic publishing, Electronic Theses and Dissertations (ETD), Institutional Repositories, Scholarly Communication, Scientometric Analysis

1. Background

A thesis or dissertation represents a novel and unique addition to the current body of knowledge within its respective discipline. The writing and presentation of a thesis is an essential academic requirement to obtain a doctoral degree, and the new knowledge generated in this process acts as a foundation for further research and gives the researcher recognition in a chosen academic discipline. Thesis is a collaborative effort of an individual researcher and research supervisor affiliated to an academic Institute. Till recently, a thesis used to be submitted in printed form, but this has changed. Many academic institutions have a policy of accepting only digital copy, while some continue to accept both in printed and digital form. The collection of printed theses submitted to an Institution for award of degree languish in closed stacks and they do not get global visibility and accessibility. Therefore, the research works do not get due evaluation and citation which leads to unnecessary duplication and repetition of a research work. To overcome the barriers posed by printed version of theses the ETDs have emerged. Electronic theses and dissertations (ETDs) are digital

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versions of theses and dissertations that are submitted electronically to a repository. There are a number of ETD initiatives that have been launched in recent years. These initiatives aim to promote the use of ETDs and to make them more accessible to a wider audience, including researchers, students, and the general public. ETDs offer numerous advantages in accessibility, searchability, multimedia integration, cost and time savings, preservation, and global reach leading to increased collaboration and innovation.

2. Literature Review

In this study, authors have delved into a comprehensive exploration of the essence, purpose, importance, and impact of Electronic Theses and Dissertations (ETDs) through a published literature on this topic. On a comprehensive literature survey, authors have been able to find very few papers.

The study by Rigby, Jones (Rigby & Jones 2020) undertook a unique quantitative analysis, examining the policies and processes related to doctoral thesis submissions in two fields within the UK. Their approach involved an innovative co-citation and network-based strategy, leading to the development of a prototype model for thesis submission formats.

In a separate investigation, (Bangani, 2018) focused on the repercussions of ETDs in the field of engineering, particularly at North-West University. The study garnered 931 citations for a total of 612 theses and dissertations, averaging 1.52 citations per individual submission. Notably, 41.2% of the theses and dissertations received at least one citation, highlighting their scholarly impact.

Furthermore, (Bansal & Bansal, 2019) conducted a global scientific analysis of the ETDs database, shedding light on research publications. This study covered 107 of research papers collected from 'Scopus' database. Over the span of 1996 to 2017, the annual growth rate of total publications saw an impressive increase of 59.75%, accompanied by an average of 4.95 citations per paper. Their study also incorporated various scientometric indicators to unveil valuable insights from the data.

Another study (Hawkins, Kimball, & Ives, 2013) contributes to the ongoing discourse on open access publishing, particularly in the context of electronic theses and dissertations (ETDs). This literature review aims to provide an overview of the article's main themes, arguments, and implications, while also situating it within the broader landscape of open access and scholarly communication. Our study on Electronic Theses and Dissertations (ETDs), entitled "A Scientometric Analysis of Research Publications," builds upon the groundwork laid by Bansal & Bansal up until 2017. However, it distinguishes itself by utilizing the latest data and employing a novel analytical approach. The same 'Scopus' database serves as the foundation for this updated exploration.

The study by Nagpaul (1995) offers a comprehensive assessment of the contributions made by Indian universities to the mainstream scientific literature. Through bibliometric analysis, the study sheds light on research productivity, impact, collaboration, and specialization trends within the Indian academic landscape. The analysis includes various bibliometric indicators such as publication count, citation counts, collaboration

patterns, and the distribution of research output across different fields. The findings provide valuable insights for policymakers, university administrators, and researchers seeking to understand the global position of Indian universities in terms of research output and influence.

In sum, the article “Mandatory Open Access Publishing for Electronic Theses and Dissertations: Ethics and Enthusiasm” contributes to the scholarly discourse on open access by examining the ethical dimensions and practical implications of mandating open access for ETDs. The insights drawn from this study presents the perspectives of various stakeholders and exploration of institutional policies make it a valuable resource for researchers, educators, librarians, and policymakers engaged in the open access movement and the future of scholarly publishing.

3. Objectives of the Study

This study uses a scientometric approach to analyse the research publications on ETDs. Scientometrics is the use of quantitative methods to study the development and growth of science. This study uses bibliometric analysis to track the number of publications on ETDs, the authors of these publications, the journals in which these publications appear, and the citations to these publications and other related aspects.

The present study guided by following scientometric objectives:

- ❖ To identify the trends in research publications on ETDs.
- ❖ To examine the factors that have contributed to the growth of research publications on ETDs.
- ❖ To identify influential authors, institutions, and countries contributing to the research publications on ETDs.
- ❖ To find out the significant topics within the domain of ETDs.
- ❖ To determine the publication sources where publications are most concentrated.
- ❖ To study the collaboration network of institutions, countries and mapping the same.

4. Methodology

For the purpose of this study, the required data was sourced from the ‘Scopus’ a bibliographic and citation database. The primary objectives of this research were to analyse trends in research publications concerning Electronic Theses and Dissertations (ETDs) within the ‘Scopus’ database, explore their bibliographic attributes, and gain a comprehensive understanding of the status of the ETDs research publications. The study encompassed an examination of all ETD publications from 1996 to 2023 (July) 2023. To retrieve the data from the ‘Scopus’ database various search terms were used, including “electronic theses,” “thesis and dissertation repositories,” and “electronic thesis and dissertation” using the following query: (TITLE-ABS-KEY (“electronic theses”) OR TITLE-ABS-KEY (“thesis and dissertation repositories”) OR TITLE-ABS-KEY (“electronic thesis and dissertation”)) OR TITLE-ABS-KEY (“ETDs repository”).

The research methodology encompassed the application of R and RStudio’s Bibliometrix package, alongside Microsoft Excel, to extract data and employ various visualization tools. The process encompassed the retrieval, integration, and analysis of pertinent publications. Furthermore, the study utilized the open-source VOSviewer application to depict the network structures of the entire publication set.

5. Analysis

This section provides an overview of research related to Electronic Theses and Dissertations (ETDs), highlighting various aspects and scope of the topic. Notably, the analysis reveals a consistent stream of literature dedicated to ETDs research, often found in secondary sources. In this study, the published literature concerning ETDs research is subjected to a quantitative analysis, employing a range of scientometric and bibliometric indicators, along with other statistical methods. The quantitative analysis is centred on the body of ETDs research literature present in bibliographic database viz, ‘Scopus’, offering valuable insights into the quantitative dimensions of this scholarly domain.

5.1. Annual Research Output

Efforts were directed towards quantifying scientific publications spanning 1996 to 2023 (July) 2023. The Table 1 details year wise publications and citations as retrieved from ‘Scopus’ database and Figure 1 illustrates annual scientific output. A total of 358 publications and 2182 citations were tallied, with an average of 6.09 per ETD-related topic. Publication frequency on ETD-related themes exhibited steady growth. In 2016, 25 publications achieved the highest rank with Mean Total Publication Average (MTPA) 9.52 and Mean Total Publications per Year (MTPY) 1.36. In 2021, 23 publications attained MTPA 0.87 and MTPY 0.43. Similar patterns were seen in 2013 (22 publications, MTPA 6.77, MTPY 0.68), and in 2018 and 2020 (21 publications each, MTPA 3.86/2.43, MTPY 0.77/0.81). This analysis highlights ETD-related research trends, both in publication and citation over time.

Table 1: Annual Research Output

Year	N	MTPA	MTPY	CY	Year	N	MTPA	MTPY	CY
1996	2	10.5	0.39	27	2010	12	5.67	0.44	13
1997	0	0	0	0	2011	11	11.45	0.95	12
1998	1	3	0.12	25	2012	9	14.44	1.31	11
1999	6	7.67	0.32	24	2013	22	6.77	0.68	10
2000	4	1.25	0.05	23	2014	18	6.78	0.75	9
2001	14	8.21	0.37	22	2015	7	6	0.75	8
2002	5	11	0.52	21	2016	25	9.52	1.36	7
2003	14	6.79	0.34	20	2017	14	7.86	1.31	6
2004	12	7.75	0.41	19	2018	21	3.86	0.77	5

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2005	13	6.92	0.38	18	2019	20	3.4	0.85	4
2006	15	8.2	0.48	17	2020	21	2.43	0.81	3
2007	13	4	0.25	16	2021	23	0.87	0.43	2
2008	16	7.88	0.53	15	2022	19	0.26	0.26	1
2009	13	11.38	0.81	14	2023	8	0		0

N= Number of Publication; MTPA= Mean Total Citation per Article; MTPY= Mean Total Citation per Year; CY= Citable Years

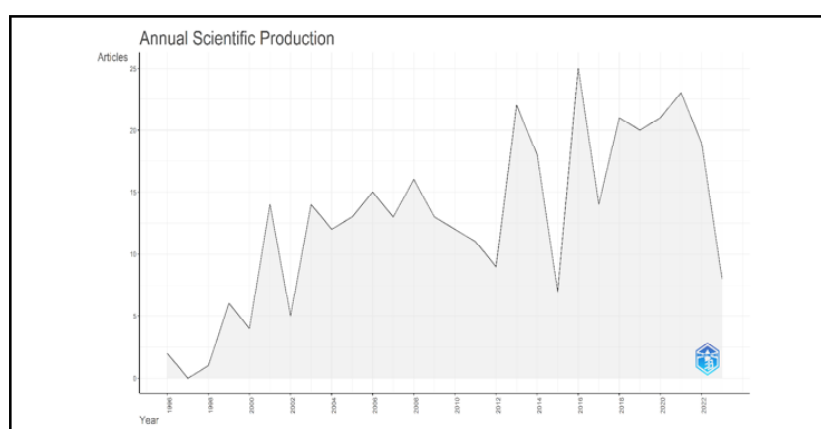


Fig 1: Annual Research Output

5.2. Distribution of Document Types in ETD-related Publications

The term “ETDs” encompasses a wide range of topics within the domain. The variety of document types considered in this study is outlined in Table 2. The ‘Scopus’ database includes different document types for the retrieved results: Journal Article, Book, Book chapter, Conference paper, Conference review, Editorial, Erratum, Note, and Review. Among the total of 358 documents, it’s notable that Journal Articles constitute the largest portion with 230 documents, followed by Conference paper (63 documents), Review (37 documents), Book chapter (11 documents), and others in descending order.

Table 2: Document Types in ETD-related Publications

Sr. No	Document Type	Number of Documents	Total Citation	Percentage of Document	Percentage of Citation
1	Article	230	1478	64.25	67.74
2	Conference paper	63	169	17.60	7.75
3	Review	37	507	10.34	23.24
4	Book chapter	11	17	3.07	0.78
5	Erratum	7	0	1.96	0.00

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6	Conference review	3	0	0.84	0.00
7	Note	3	6	0.84	0.27
8	Book	2	3	0.56	0.14
9	Editorial	2	2	0.56	0.09

5.3. Research Publications on Language

The study identified six (06) scholarly presentation languages: Chinese, English, French, Persian, Portuguese, and Spanish. Among these, English stands out with the highest representation, accounting for 343 documents. Spanish follows with 5 documents, while Chinese and Portuguese each contribute 4 documents, respectively. French and Persian each contribute 1 document, and Persian contributes 0 documents.

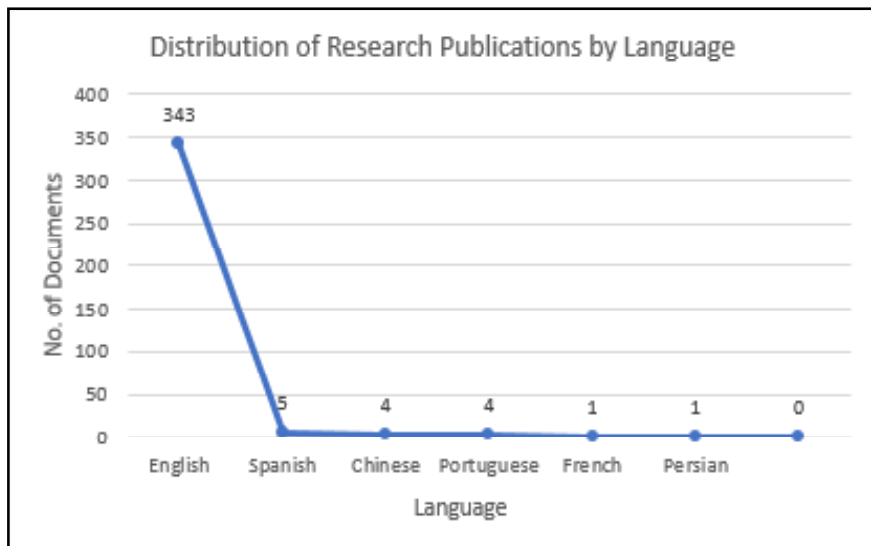


Fig 2: Distribution of Research Publications by Language

5.4. Authorship Pattern

Table 4 presents the distribution of authorship across different years. The analysis reveals that among the 358 publications, there were 920 unique authors, with 684 authors contributing to multiple publications. Among the 358 documents, 122 were authored by a single individual, 101 by two authors, 58 by three authors, 29 by four authors, 16 by five authors, 20 by six authors, 2 by seven authors, 4 by eight authors, 2 by nine authors, 2 by ten authors, and 2 by eleven authors.

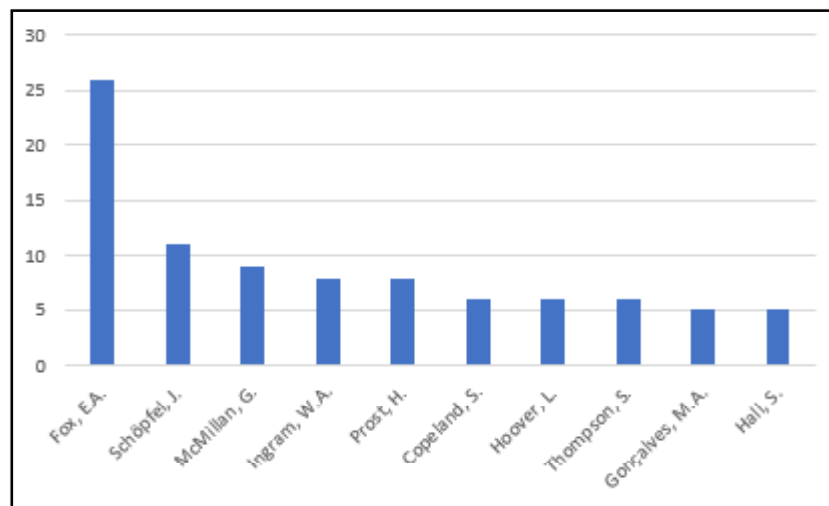
This data highlights that single-authored papers constitute the majority of the total 358 publications, followed by those with two authors and three authors. Notably, there is a noticeable distinction in author distribution between single-authored and multi-authored documents. The prevalence of single authors is more prominent, while multi-authored publications are relatively fewer in number.

Table 3: Authorship Pattern

Authorship Pattern	No. of articles	%
Single author	122	34.08
Two authors	101	28.21
Three authors	58	16.20
Four authors	29	8.10
Five authors	16	4.47
Six to Eleven authors	32	8.94
Total	358	100

5.5. Top 10 Prolific Authors

The analysis of the prolific authors helps to identify the topic researchers/authors working on particular research area. The following list showcases the ten most prolific authors in the realm of scientometric studies concerning Electronic Theses and Dissertations (ETD) publications. These authors have significantly enriched the understanding of ETD-related research through their substantial contributions. At the forefront is E.A. Fox, whose impressive body of work comprises 26 publications, reflecting a deep commitment to advancing the field. Notably, J. Schöpfel follows with 11 publications, while G. McMillan, W.A. Ingram, and H. Prost, along with several others, have each authored 8 to 6 publications, underscoring their collective dedication to advancing knowledge in this specialized domain. Collectively, these authors' extensive research outputs serve as a cornerstone for scholars and practitioners delving into the intricacies of ETD-related studies.

**Fig 3: Top 10 Prolific Authors**

5.6. Degree of Collaboration

Various methodologies have been utilized to assess the extent of research collaboration. In this study, the approach proposed by Subramanyam (1983) was adopted for this purpose (Subramanyam, 1983, as cited in (Kumar & Behera, 2022)).

The degree of collaboration (DC): $DC = \frac{Nm}{Ns + Nm}$

Where,

DC = Degree of collaboration in a Topic

Ns = Number of single documents in the Topic

Nm = Number of multi-authored documents in the Topic

So, As per our Formula

Ns = 122

Nm = 236

Ns+Nm = 358

Thus, **0.65** represents the degree of collaboration (DC) on the topic of ETDs from 1996 to 2023 (July).

Table 4: Degree of Collaboration

Year	Single Author (Ns)	Multiple Author (Nm)	Ns+Nm	Degree of Collaboration
1996	1	1	2	0.50
1998	0	1	1	1.00
1999	1	5	6	0.83
2000	2	2	4	0.50
2001	7	7	14	0.50
2002	1	4	5	0.80
2003	2	12	14	0.86
2004	5	7	12	0.58
2005	7	6	13	0.46
2006	7	8	15	0.53
2007	3	10	13	0.77
2008	9	7	16	0.44
2009	7	6	13	0.46

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2010	6	6	12	0.50
2011	5	6	11	0.55
2012	2	7	9	0.78
2013	10	12	22	0.55
2014	5	13	18	0.72
2015	2	5	7	0.71
2016	10	15	25	0.60
2017	4	10	14	0.71
2018	7	14	21	0.67
2019	5	15	20	0.75
2020	4	17	21	0.81
2021	6	17	23	0.74
2022	3	16	19	0.84
2023	1	7	8	0.88
	122	236	358	

5.7. Top 10 Sources

Diverse studies concerning Electronic Theses and Dissertations (ETDs) and their associated research have found their way into various journals. The ranking of these journals based on metrics like Number of Publications (NP), CiteScore, SNIP, and SJR is presented in Table 6.

Notably, Library Philosophy and Practice (currently not covered) emerges as the most prolific journal, boasting the highest Number of Publications at 21. This journal has commenced its publication journey. Noteworthy contributions in the field of ETDs are also featured in the noted and widely used Lecture Notes in Computer Science, recognized for presenting cutting-edge research.

Of particular significance is the Proceedings of the ACM/IEEE Joint Conference on Digital Libraries, which has published 13 impactful research articles. Additionally, D-Lib Magazine (no longer published was available up to 2017 July) presents 12 relevant publications, followed by Journal of Academic Librarianship and Technical Services Quarterly, each contributing 10 valuable studies, and so forth.

Table 5: Top 10 Sources

Sources	Number Articles	CiteScore 2022	SNIP 2022	SJR 2022
Library Philosophy and Practice (Currently Not Covered)	21	0.4	0.233	0.235
Lecture Notes in Computer Science	14	2.2	0.32	0.542

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Proceedings of the ACM/IEEE Joint Conference on Digital Libraries	13	-	-	-
D-Lib Magazine	12	2.4	0.208	1.438
Journal of Academic Librarianship	10	4.1	0.899	1.694
Technical Services Quarterly	10	0.5	0.173	0.608
Cataloging and Classification Quarterly	9	0.7	0.199	1.583
International Information and Library Review	9	2.3	0.401	0.617
Library Hi-Tech	9	4.9	0.507	1.217
Grey Journal	8	1.7	0.211	0.476

5.8. Bradford's Law

Bradford's Law of scattering introduces a conceptual framework in which a subject is envisioned as a sequence of concentric zones, commencing from a central "core" and expanding outward. In this progression, the quantity of pertinent articles in each zone is approximately equivalent to the core's count. As we move outwards, more journals are needed to accommodate the increasing number of relevant articles. Bradford's Law is mathematically expressed through a verbal formulation that employs a multiplier. This multiplier is obtained by dividing the number of journals in a given zone by the number of journals in the preceding zone.

For the purpose of this study, the publications were categorized into three distinct zones. The graphical representation of Bradford's Law is depicted in Figure 3, illustrating this progression and distribution across zones.

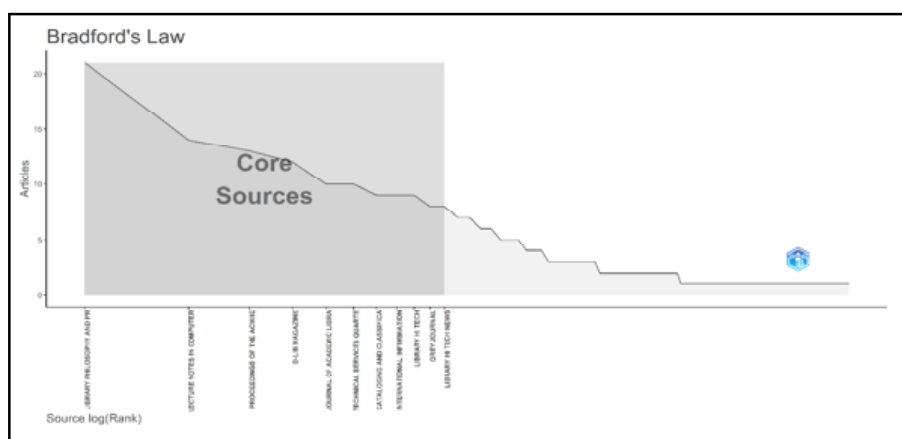


Fig 4: Bradford's Law

5.9. Distribution of Documents by Affiliations

Studying the progression of affiliations' contributions in research publications presents valuable insights into the dynamic evolution of academic collaboration and scholarly contributions. This analysis provides a

window into the changing landscape of research networks and collaborative endeavours across various academic fields. Through the lens of affiliations' production, we gain a nuanced understanding of how academic partnerships and collaborations have developed and transformed over time. This trend analysis is instrumental in capturing the impact of technological advancements, the rise of interdisciplinary approaches, and the increasing interconnectedness within the global scholarly community.

The historical evolution of affiliations' production showcases a notable shift in focus. Initially, early research publications often highlighted individual authorship and institutional affiliations as key markers of scholarly contributions. However, as the complexity of research challenges grew, necessitating diverse expertise, there emerged a gradual transition towards collaborative authorship. This shift led to increased involvement of researchers from varied institutions and even different countries, reflecting the growing importance of multidisciplinary and global collaborations. To provide a visual representation of these trends, Figure 4 presents the data in a graphical format, allowing for a clear and intuitive understanding of affiliations' production over time. Various institutions and their respective contributions to Electronic Theses and Dissertations (ETDs). Virginia Polytechnic Institute and State University stands out with the highest count of 38 ETDs, showcasing a strong commitment to fostering academic exploration. Université de Lille follows with 15 ETDs, while Kent State University, Mississippi State University, Texas A&M University, and Universidade Federal do Rio Grande do Norte have each contributed 7 ETDs, highlighting their dedication to knowledge dissemination. Additional institutions, including Groupement d'Etudes et de Recherche Interdisciplinaire en Information et Communication (GERIICO), University of Houston, Robert Gordon University, University of Kashmir, Old Dominion University, West Virginia University, University of North Texas, and Mississippi State University Libraries, have also actively contributed between 5 and 6 ETDs, collectively enriching the academic landscape. These combined efforts underscore the institutions' significant roles in advancing scholarly research and promoting intellectual growth.

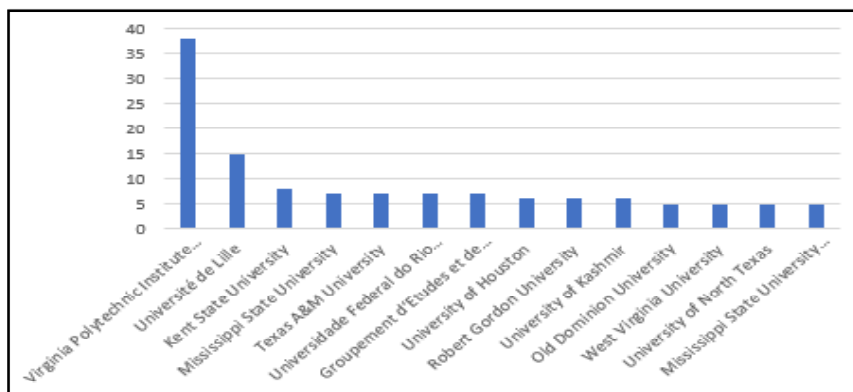


Fig 5: Distribution of Documents by Affiliations

5.10. Co-Authorship Dynamics

Co-authorship relationships among authors are established based on the frequency of their collaborative works. This analysis involves selecting co-authors from the “types of analysis” within a designated “unit

of analysis.” The counting method employed includes options for full counting or fractional counting, with a minimum requirement of three documents for an author’s inclusion in the analysis. Among the total authors, six authors meet the specified criteria. For each of these six authors, the cumulative strength of co-authorship connections with other authors is calculated. The sources with the highest total link strength are then identified. This process yields six full items and six distinct clusters.

Figure 4 visually represents these clusters and their corresponding contents. Each cluster contains a specific number of items, showcasing the collaborative connections between authors. Cluster 1 holds one item, Cluster 2 also contains one item, and this pattern continues with Clusters 3 through 6, each consisting of one item.

Total Links: 06

Total Link Strength: 06

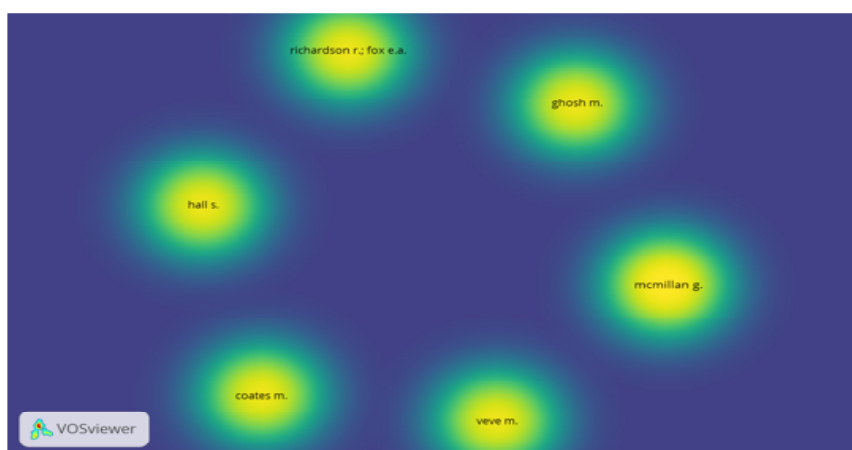


Fig 6: Co-Authorship Dynamics

5.11. Keywords Co-Occurrence Analysis

A comprehensive analysis of keyword interconnections is established through the assessment of co-occurrences in research documents. Co-occurrences are derived from the “types of analysis,” with author keywords selected as the “unit of analysis.” The counting method options include full counting or fractional counting, and a keyword must appear a minimum of five times to be considered for analysis. Among the total of 1688 keywords, 82 keywords fulfil the prescribed criteria. For each of these 82 keywords, the cumulative strength of co-occurrence links with other keywords is calculated. Keywords with the highest total link strength are identified. This process yields 82 full items and four distinct clusters. It’s important to note that keyword variations arising from different formatting approaches (such as hyphens, dots, commas, dashes, slashes, and plurals) have been reconciled through merging, thus optimizing the software’s clustering capability. Figure 5 visually portrays these clusters and their contents. Cluster 1 encompasses 26 items, as does Cluster 2. Cluster 3 comprises 20 items, and Cluster 4 contains 10 items.

Total Links: 949

Total Link Strength: 2107

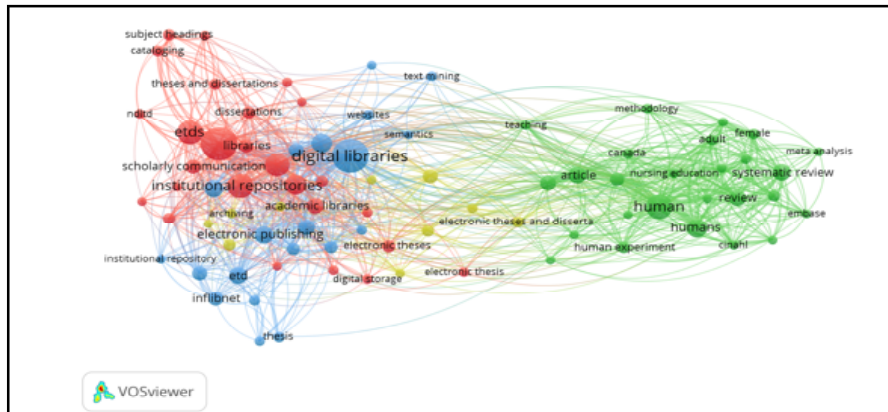


Fig 7: Keywords Co-Occurrence Analysis

5.12. Author Bibliographic Coupling

Figure 6 presents an intricate network depicting the coupling relationships among documents within the ETDs domain. Among the total of 358 documents, all meet the specified criteria, resulting in 358 documents under consideration. For each of these 358 documents, the cumulative strength of bibliographic coupling links with other documents is calculated. Documents with the highest total link strength are selected. This process generates 169 full items, which are subsequently grouped into 17 distinct clusters. The visualization of these clusters within Figure 6 offers valuable insights. Cluster 1 comprises 18 items, Cluster 2 contains 17 items, and Clusters 3 through 6 each encompass 14, 13, 13, and 11 items respectively. Additionally, Clusters 7 through 10 have 10, 9, 8, and 8 items respectively, while Clusters 11 through 15 encompass 7, 7, 7, 6, and 4 items. Lastly, Cluster 16 includes 3 items, and Cluster 17 features 3 items as well.

Total Links: 656

Total Link Strength: 1118

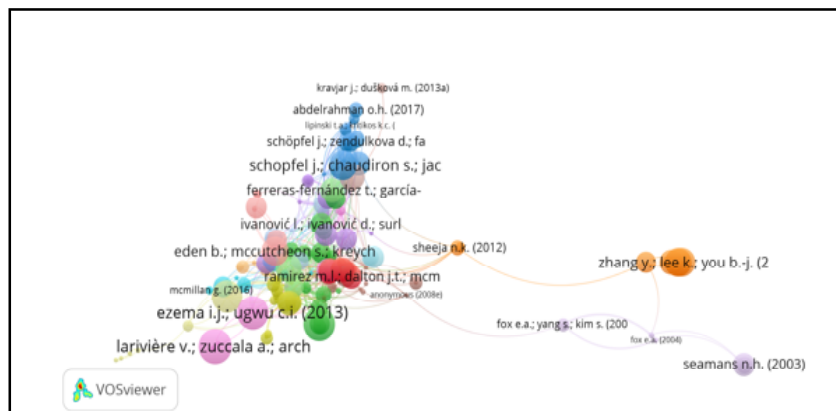


Fig 8: Author Bibliographic Coupling

5.13. Word Cloud Representation

Figure 7 presents an analysis of keywords used in the titles of ETDs. The title field was selected with a limit of 50 words and focusing on unigrams. The resulting word cloud illustrates the frequency of keywords within titles. Notably, the keyword “Theses” emerges as the most prevalent, followed by “electronic” (142 occurrences), “dissertations” (140 occurrences), “digital” (51 occurrences), “access” (43 occurrences), “university” (42 occurrences), “ETD” (38 occurrences), “library” (36 occurrences), “ETDs” (35 occurrences), “study” (35 occurrences), and others. The word cloud visually represents the prominence of these keywords within the titles of ETDs.

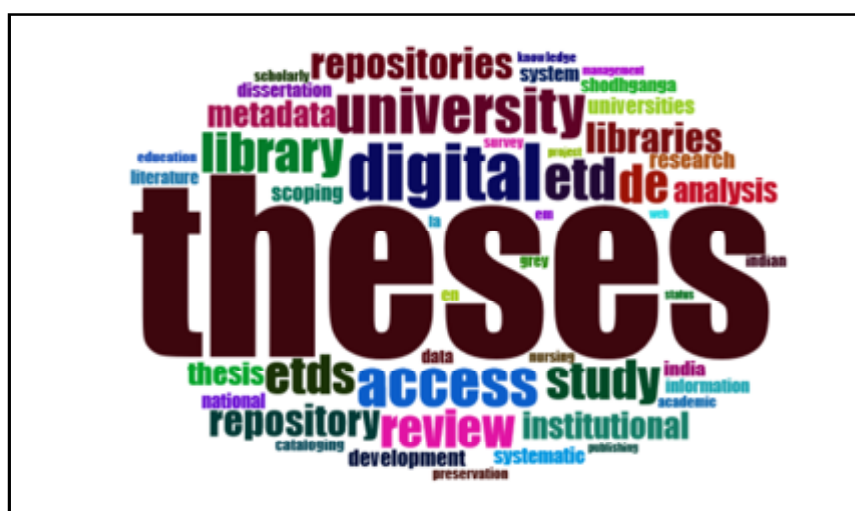


Fig 8: Word Cloud Representation

6. Conclusions

This study has provided a scientometric analysis of research publications on Electronic Theses and Dissertations (ETDs). The results of this study suggest that ETDs are a growing and important source of scholarly research. The findings of this study have a number of implications for researchers, librarians, and policy makers. Providing clear and concise metadata for ETDs, researchers and librarians can help increase the chances of ETDs being indexed in ‘Scopus’. This will make it easier for researchers to find and use ETDs and help ensure that ETDs are recognized as a valuable source of research.

The research findings present the total publications on ETDs covering the period from 1996 to 2023, cumulated to 358 documents, registering 4.15% growth per annum, a Document Average Age of 10.5, and averaged 6.059 citations per paper. The study also reveals the highest number of Publications published in 2016; the United States accounted for the highest (approximately 50%) publication share. Social Science is one of the most popular areas of research on ETDs, followed by Computer Science and Arts and Humanities. The study identifies the topmost productive organizations, authors, journals and highly cited papers. The study

also identifies authorship patterns, degree of collaboration among authors, co-authorship, keywords co-occurrence, citation, bibliographic coupling, co-citation mapping stating electronic theses, and dissertations research. The study shows the research publications on ETDs with different metrics parameters.

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