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Bibliometric Analysis of Digital Divide Using Web of Science

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Bibliometric Analysis of Digital Divide Using Web of Science

ABSTRACT

The "digital divide" refers to the gap between those people who have access to information and communication technologies (computer, cellphones, especially smart phones, digital hardware, software and internet) and those who don't. Literature show that digital divide has been explored extensively in different perspectives. The main objective of the current study is to look at the bibliometric examination of research output on the "Digital Divide" literature published in the Web of Science from 1999 to 2021, using bibliometric and visualization techniques. Initially, minimum number of 14 keywords occurrences are selected in which 70 keywords out of 5127 finalized. For the Keywords analysis VOS-viewer were used. Five keywords "Digital Divide", "Internet", "ICT", "Digital Inequalities" and "Digital Literacy" truly represent the nature of the current research.

Finally, 2443 documents on "Digital Divide" indexed in the Web of Science database were analyzed, including Articles, Proceeding papers, Reviews, and book Chapters. Among all of them the most occurring document is Article (1632). For data analysis and bibliometric indicator extraction, the bibliometric method based on the R package, Excel, MS-Access, and VOS-viewer software packages were used. This study reveals the research work, productivity and publication of different authors on Digital Divide. Further, this work provided some pertinent information about the most productive countries, organizations, and authors, preferred types of researcher's sources and authorship collaboration in Digital Divide research as well as prominent research's citations and their use. Similarly, based on the data collected, the focus was on top-ranked publications. Leading countries, institutes, journals, articles, authorships, keywords, collaborative research networks, leading scholars, and keywords were all included in the analysis.

Results show that the article "The digital divide as a complex and dynamic phenomenon" published in 2003 have the highest citation 546 published in the journal "Information Society". It reveals that most of the articles on "Digital Divide" included in the current study have reasonable citation because the least cited article among top 20 had 216 citations. Further, collaboration of two authors, closely followed by one, three and four authors has been found regarding the publications on "Digital Divide".

Among top 20 most productive countries on "Digital Divide", USA is the most productive country with 780 documents, followed by England and Spain with 186 and 161 respectively. Similarly, when looking at the leading research institutions "Tilburg University" appeared one of the highest productive institute have "Tilburg University" leads the research institute list with 26 publications in this area. Most prolific author in this field is "Jams J", who published 23 articles. The highest bilateral collaboration has been observed between the United States and China.

This study emphasis on the patterns of scholarly communication in the digital divide research. These trends would benefit scholars from a variety of fields by identifying the core areas, main authors, and core publications that produce this content. It also encourages scholars to do collaborative and multidisciplinary research on the digital divide in order to gain deep and practical knowledge. Leading countries, institutes, journals, articles, authorships, keywords, collaborative research networks, leading scholars, and a three-factor analysis of leading countries, institutions, and keywords were all highlighted in the analysis.

Introduction

The digital divide generally applies to the difference between those who do not have access to modern types of information technology and those who do. (Dijk, 2017)

The “Digital Divide” rapidly became one of the “hot topics” of the 1990s in political and academic circles. The sustained empirical image of inequality in the use of information and communication technology (ICTs), in particular computers and the internet, was illustrated in a series of significant surveys and studies in the US and Europe. This digital divide has been widely seen as occurring between technological “haves and have-nots” or “information rich” and “information poor” cadres. (Selwyn & Facer, 2010).

In another study, “Digital Divide” is difference between people who live in cities and those who live in rural areas, between those who are educated and those who are uneducated, between those who are economically well off and those who are not, and between those who live in developed, emerging, and least developed countries. People round the globe can be separated into two groups: those who have access and the ability to use modern artifacts such as telephones, televisions, and the Internet, and those who do not. (Rao, 2005)

Furthermore, The “Digital Divide” splits those who can gain these advantages by accessing and using ICT, and those who either do not have access to or are unable to use such technologies for one or more purposes. (Vahid Aqili & Isfandyari Moghaddam, 2008)

Furthermore, the digital divide isn't everything, what it appears to be. The gap between people who can and cannot effectively use information technology is just one of several inequalities impacting low-income countries, both national and international, urban and rural, rich and poor. (Brooks, Donovan, & Rumble, 2006)

Cullen (2001) looked at a variety of topics, contributing factors, and evaluation methods for reducing the global Digital Divide. Fourie and Bothma (2006) argued that the Digital Divide is about more than just having access to information and communication technology and being able to use it. Mutula (2005b) argues that existing research on the Digital Divide largely rely on ICT indicators, with little consideration for the full range of other factors that influence the Digital Divide. Akca, Sayili, and Esengun (2007) limited internet connectivity and the design of village Web pages can be a barrier to e-commerce adoption, (duplication page 11) obtaining news and official data, sharing and transferring knowledge, advertising rural products and landscapes (agricultural, handicrafts), selling and purchasing agricultural inputs and outputs, education and training operations, and interpersonal contact. Brooks et al. (2005) stated that a lack of essential computer and internet expertise, as well as a lack of English-language competence, all impede the development and use of digital information resources. Dijk (2017) defines Digital Divide as the gap between those who have and those who do not have access to computers and the Internet, has been a central issue on the scholarly and political agenda of new media development. Chao and Yu (2016) are of the view that the digital divide is a problem because knowledge access disparity can have a direct impact on social growth and quality of life. Johansson, Gulliksen, and Gustavsson (2021) identified internet usage and perceived challenges among people with disabilities in a study, as well as exploring digital differences between and within disability classes and also in comparison to the general population. Collins, Yoon, Rockoff, Nocenti, and Bakken (2016) emphasizes that digital divide and information needs to contact with family members who live abroad can be a considerable cost hardship for low-income foreign-born people. Wan (2020) claims that the digital divide is a real issue in libraries, focusing on the

potential effect of community size on unfair distribution of electronic resources across public libraries in Iowa.

A lot of studies are available on digital divide but there is not a single bibliometric study conducted so far. So, there is a need of conducting a bibliometric study to investigate the statistics about “Digital Divide”.

The basic concept behind bibliometric is to measure people's and institutions' academic performance. In the second step the figures and values are then used to draw qualitative conclusions. Scientists, academic managers and policymakers, as well as all strategic decision-makers at universities, research centers, and ministries, are all concerned with the quality and evaluation of academic results (for bibliometrics, written output). Furthermore, both public and private donors insist on categorizing and evaluating academic quality standards. Bibliometrics is one way that can be utilized to do this. The bibliometric approach is an indirect method for determining academic excellence by quantifying academic output and publications. Bibliometrics, on the other hand, is primarily concerned with measuring the impact of publications. However, the term "publishing" has so far been relatively ambiguous: There are books, book chapters, journal articles, and conference papers in it. With the advent of the internet and advancements in academic communication, this term has grown increasingly ambiguous. Anyone who utilizes bibliometrics today must be clear about what is being measured and what type of publication would serve as the foundation for individual bibliometric analyses and statements. (Ball, 2018)

There are many other bibliometric studies conducted in other fields (Wastewater, Diabetes, Green marketing, Researchers competencies etc.). There is a lot of literature published on digital divide. Digital divide is present due to unequal distribution of technology. There is not a single bibliometric study found on ‘Digital Divide’ Therefore, this study aims to explore the reasons, inducements and objectives behind the explosive growth in the literature on Digital Divide.

Hoffman and Novak (1998) investigated the effect of race on computer and internet usage by white and black Americans in the United States. They concluded that 44.2 percent of White Americans and 29.0 percent of Black Americans had access to computers. Although (26 percent vs. 22 percent) would use the internet. (Report)

Cullen (2001) in his study looked at a variety of topics, contributing factors, and evaluation methods for reducing the global Digital Divide.

van Dijk and Hacker (2003) presented a useful analytical method for data allegedly linked to the "digital divide" phenomenon. Official statistics show that, at least in the United States and the Netherlands, income, education, age, and ethnicity gaps in the possession of computers and hardware grew during the 1980s and 1990s. The gender divide in ICT ownership began to close in the 1990s. The study also emphasized the ever-changing essence of every digital divide. They believed that in the first decade of the twenty-first century, information and communication technology would diverge significantly. Computers would be available in a variety of devices, from the most basic (palm-top and other) to the most sophisticated (desktops, notebooks, and servers). In addition to fast broadband connections, “the Internet” would be accessible via televisions, cell phones, and other small information devices.

Hersberger (2003) explored the impact of the Digital Divide on the economically poor in the United States, he analyzed their information needs, seeking behavior, and information sources. The inability to locate necessary information in electronic formats was described as a

major cause of Digital Divide. Lack of transport facilities, high cost of internet and inability to locate relevant sites were the major hindrances in the use of internet.

Rao (2005) presented stats on bridging the digital divide in India, steps like uninterrupted supply of energy, IT penetration, teledensity and reforms in internet industry turn India to turn into an information society. Various networking technology options leads India in bridging the Digital Divide. He further said that improved literacy rate and development of user friendly IT tools are major factors in bridging the Digital Divide. He came to the conclusion that providing access, content production, capacity building, core technology, creation and exploitation, cost reduction of IT equipments, community engagement, and dedication to the deprived and disadvantaged will all contribute to reducing the Digital Divide.

Mutula (2005a) addressed the status of Africa's Digital Divide, as well as its consequences for libraries and academic settings. In the light of a general literature review, countries like Africa are still struggling, and resources that could be used to bridge the digital divide are focused on meeting people's basic survival needs, such as food, shelter, health, treatment, and housing. Moreover, governments are gradually implementing e-government programs, which libraries will want to investigate for automation. Just a few studies have looked into the potential of e-governance in terms of library automation. Issues, patterns, prospects, and opportunities of the digital divide have previously been examined mostly from a national/international perspective, with little attention given to the phenomenon's existence within libraries. Existing research on the Digital Divide largely rely on ICT indicators, with little consideration for the full range of other factors that influence the Digital Divide. Governments and libraries can become partners in the e-governments relationship in Africa's information age by using ICTs.

Brooks et al. (2005) stated that a lack of essential computer and internet expertise, as well as a lack of English-language competence, all impede the development and use of digital information resources. "Individual librarians, regional library consortia, governmental ministries, scholarly publishers, and database producers like EBSCO can reach across national and cultural boundaries to effect change in developing regions, but a collaborative effort of many participants including, but not limited to(duplication with above paragraph) individual librarians, regional library consortia, governmental ministries, scholarly publishers, and database producers like EBSCO is essential to successfully bridging the gaps (digital, cultural, and financial) that still separate many countries of the world".

Aissaoui (2020) in a recent report, Coronavirus (COVID-19) has uncovered the "Digital Divide" more than ever before, making it an interesting fact. In this work, a best-in-class evaluation thinks that managed the three levels of the advanced gap and highlight its shortcomings in light of COVID-19 are introduced. An integrative literature review was carried out. It can be stated that researchers have not sufficiently exposed and investigated the "Digital Divide". In reality, very few research papers have focused on the first-level divide in recent years. Furthermore, much of the literature has examined the second digital divide (in terms of e-skills) in a narrow and national context. This research also demonstrates that existing studies on the third level-digital divide focus solely on individual Internet usage results. Finally, it is suggested that future research on the three-level digital divide investigate further digital inequalities related to developing technologies. This paper presents the state of the art, which has important theoretical and practical implications for the effectiveness of full digitization. An important practical lesson is that the "Digital Divide" is highly complex, and that the COVID-19 increased it. To get the most out of ICT and assure the success of full digitalization in all areas of

life, countries must first bridge the first level “Digital Divide” by boosting access and connectivity for homes, businesses, government agencies, and universities. Furthermore, it is important to improve e-skills through increasing ICT training and emphasizing the usage of developing technologies. Our study's findings also have a number of practical consequences. The current study contributed to the existing of knowledge on digital inequality by summarizing key concepts and findings from the literature on the three levels of the “Digital Divide”. It emphasizes undiscovered research issues on some elements of “Digital Divide” that were at the root of many nations' digital transformation failures and provides insights on future research directions in light of COVID-19.

This study offers an overview of the worldwide distribution of author’s contribution to knowledge, professional history and academic activities, establishes research performance patterns, and anticipates future authorship trends and directions. The need for a comprehensive study of the publishing of literature is undeniable. In Digital Divide, this research is needed to provide basic details about the authorship of Digital Divide that can be used in potential comparative examinations. The aim of this bibliometric analysis is to contribute quantitative information on specific issues, including geographic concentration, gender balance, geographical distribution of male and female professors and managers, degree of cooperation in research, degree of dispersion of subjects and preferences for citation. For scholars, practitioners, institutions, and policymakers in the field, the results of this study will be valuable, as this study could shed light on the most important scholars and literature in the field. More importantly, this study can provide indicators and data to help develop future Digital Divide program curricula as a discipline and to help establish the field's best practice as a profession. Additionally the objective of the study was:

1. To analyze publishing trends on digital divide from 1999 to 2020.
2. To analyze the preferred journals in which researchers like to publish their work related to digital divide.
3. To analyze the authorship patterns of research in digital divide.
4. To analyze which are the most productive countries, organizations and authors on digital divide.
5. To analyze those digital divide research articles with exploration of keywords analysis and highly cited articles by digital divide researchers.
6. To analyze most used document type in digital divide research.
7. To analyze the country collaboration of research in digital divide.

Methodology

In this study bibliometric method is used to investigate the literature published on “Digital Divide”. Studies in scientific and applied sciences are examined using this method. Ellegaard and Wallin (2015) in bibliometric research, used mathematical/statistical approaches to find trends and patterns in written journals, conference papers, and academic records in terms of publications, citations, authorship, co-authorship, and collaboration between regions and organizations. Durisin, Calabretta, and Parmeggiani (2010). This allows researchers to review published literature without having to contact the authors. (Garfield & Merton, 1979)

Database selection

Many online database services, such as Web of Science (WOS), Scopus, Google Scholar, MELINE, and PubMed, give bibliographic information on published research, including articles, reference papers, and review articles. This study makes use of WOS, which has resources in the sciences, social sciences, arts, and humanities. WOS was chosen for this study because it is

widely regarded as the most powerful, dependable, and trusted database among professionals and researchers (Saleem, Khattak, Ur Rehman, & Ashiq, 2021) WOS also released Journal Citation Reports (JCR) on an annual basis, which included impact factor journals that indicated the quality of journals.

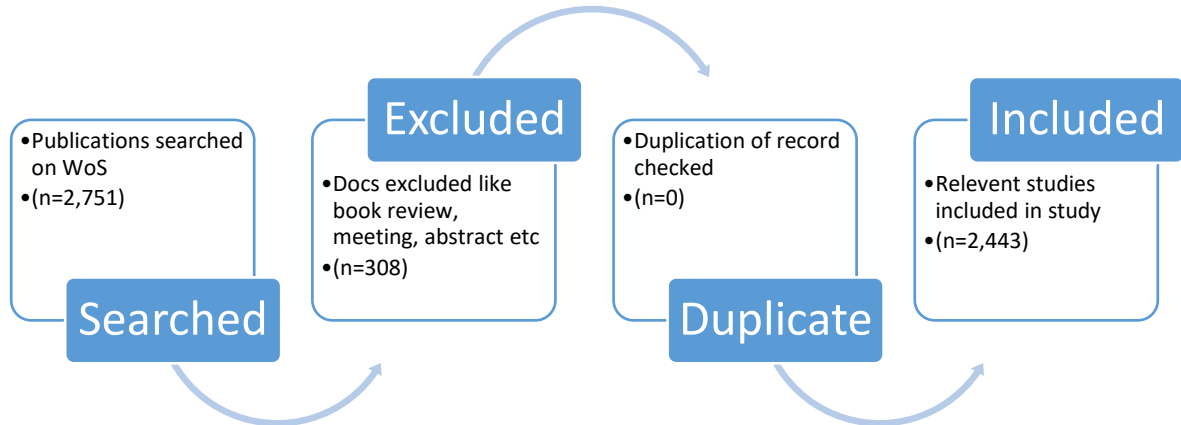
Search query

The query was used to quickly get an understanding of the publication on “Digital Divide” of the title T1 field of web of science. The following syntax was used to conduct a literature search:

TI= ("Digital Divide") OR AK= ("Digital Divide")

Inclusion/Exclusion criteria

The above query (on April 9, 2021) returned 2,751 records from the Web of Science Core Collection. The WOS SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI, CCR-EXPANDED, and IC indices were used in the search. Since no time limit was specified when searching the above query, the downloaded search results contained all records up to April 9, 2021. Duplication of records was tested for downloaded data by importing the dataset into EndNote, and no duplicate records were discovered. Then downloaded data were refined by excluding by publication year 2021, remaining results were 2,689. Further data refined by the excluding documents types (Book review or meeting abstract or correction or news item or editorial material or letter) remaining results were 2,443 records.



The data records in this analysis were examined using Microsoft Access, Microsoft Excel, VOSviewer, and Biblioshiny. Many researchers use VOSviewer (Kawuki, Yu, & Musa, 2020; Martynov, Klima-Frysch, & Schoenberger, 2020; Merigó, Pedrycz, Weber, & de la Sotta, 2018; Xie, Zhang, Wu, & Lv, 2020) and Biblioshiny (Homolak, Kodvanj, & Virag, 2020; Janik, Ryszko, & Szafraniec, 2020).

Data was extracted from Web of Science in plaintext format and then imported into Microsoft access, Excel, Biblioshiny and Vosviewer to perform the detailed analysis.

Data Analysis

Basic information

The following is some basic details about the literature on "Digital Divide" that has been published:

Table 1 Basic information about literature published on “Digital Divide”

Description	Results
Timespan	1999:2021
Sources (Journals, Books, etc)	1261
Documents	2443
Average years from publication	8.04
Average citations per documents	16.1
Average citations per year per doc	1.717
References	67011
DOCUMENT TYPES	
Article	1646
Article; book chapter	3
Article; early access	36
Article; proceedings paper	68
Proceedings paper	650
Review	40
DOCUMENT CONTENTS	
Keywords Plus (ID)	1746
Author's Keywords (DE)	5263
AUTHORS	
Authors	5235
Author Appearances	6382
Authors of single-authored documents	602
Authors of multi-authored documents	4633
AUTHORS COLLABORATION	
Single-authored documents	683
Documents per Author	0.467
Authors per Document	2.14
Co-Authors per Documents	2.61
Collaboration Index	2.63

Table 1 shows the total literature which is published on “Digital Divide”. In the view of this table from 1999 to 2021 there is lot of literature published on “Digital Divide”. These stats shows the source, Document types, Document content, Authors and Author collaboration. It indicates that 5235 authors contributed to a total of 1646 articles. There are a lot of authors here. More scientists are participating in the publishing of research papers as a result of funding.

Preferred journals

Following are the details about the preferred journals from the researchers for the publication of their literature on “Digital Divide”. Top twenty articles are shown in given table, the article have highest Citation 546 is “The digital divide as a complex and dynamic phenomenon” published in the year 2003, in journal “Information Society”, U1=13 and U2=191, followed by” Digital inequality - Differences in young adults' use of the Internet” have citation 515 published in year 2008, in journal Communication research, U1=16 and U2=242, “Gradations in digital inclusion: children, young people and the digital divide” have 502 citation, published in year 2007, in journal “New Media and society”, U1=38 and U2=277, “Digital divide research, achievements and shortcomings” have 493 citations, published in year 2006, in journal “Poetics”, U1=15 and U2=126, “Reconsidering political and popular understandings of the digital divide” have 470 citations, published in year 2004, in journal “New Media and Society”, U1=12, and U2=114, “Characteristics of online and offline health information seekers and factors that discriminate between them” have citations 448, published in year 2004, in journal “Social Science and Medicine”, U1=11 and U2=114, “The digital divide shifts to differences in usage” have citations 394,, published in year 2014, in journal “New Media and Society”, U1=43 and U2=304, “Health information, the Internet, and the digital divide” have citations 323, published in year 2000, in journal “Health affairs”, U1=10 and U2=57, “Internet skills and the digital divide” have citations 311, published in year 2011, in journal “New Media and Society”, U1=24 and U2=238, “Shaping the Web: Why the politics of search engines matters” have citations 311, published in year 2000, in journal “Information society”, U1=3 and U=27, “Older adults' use of information and communications technology in everyday life” have citations 296, published in year 2003, in journal “Ageing and society”, U1=3 and U2=111, “Comparing internet and mobile phone usage: digital divides of usage, adoption, and dropouts” have citations 294, published in year 2003, in journal “Telecommunications Policy”, U1=7 and U2=153, “Understanding digital inequality: Comparing continued use behavioral models of the socio-economically advantaged and disadvantaged” have citations 289, published in year 2008, in journal “MIS Quarterly”, U1=13 and U2=201, “The Internet and knowledge gaps - A theoretical and empirical investigation” have 286 citations, published in year 2002, in journal “European Journal of communication”, U1=12 and U2=89, “Effect of computer support on younger women with breast cancer” have citations 263, published in year 2001, in journal “Journal of General Internal Medicine”, U1=0 and U2=20, “eHealth Literacy: Extending the Digital Divide to the Realm of Health Information” have citations 251, published in 2012, in journal “Journal of medical internet research”, U1=22 and U2=193, “The determinants of the global digital divide: a cross-country analysis of computer and internet penetration” have citations 240, published in year 2007, in journal “Oxford Economic Papers New Series”, U1=12 and U2=89, “Social disparities in internet patient portal use in diabetes: evidence that the digital divide extends beyond access” have citations 224, published in year 2011, in journal “Journal Of American Medical Informatics Association”, U1=2 and U2=73, “Digital inequalities and why they matter” have citations 224, published in year 2015, in journal “Information Communication and Society”, U1=45 and U2=328 and at the end ” The digital divide: the special case of gender” have citations 216, published in year 2006, in journal “Journal of Computer Assisted Learning”, U1=4 and U2=83.

Table 2 Top journals which are preferred by researchers for the publication of their work

TI	TC	U1	PY	SO	U2
“The digital divide as a complex and	546	13	2003	“INFORMATION	191

dynamic phenomenon”				SOCIETY”	
“Digital inequality - Differences in young adults' use of the Internet”	515	16	2008	“COMMUNICATION RESEARCH”	242
“Gradations in digital inclusion: children, young people and the digital divide”	502	38	2007	“NEW MEDIA & SOCIETY”	277
“Digital divide research, achievements and shortcomings”	493	15	2006	“POETICS”	126
“Reconsidering political and popular understandings of the digital divide”	470	12	2004	“NEW MEDIA & SOCIETY”	114
“Characteristics of online and offline health information seekers and factors that discriminate between them”	448	11	2004	“SOCIAL SCIENCE & MEDICINE”	114
“The digital divide shifts to differences in usage”	394	43	2014	“NEW MEDIA & SOCIETY”	304
“Health information, the Internet, and the digital divide”	323	10	2000	“HEALTH AFFAIRS”	57
“Internet skills and the digital divide”	311	24	2011	“NEW MEDIA & SOCIETY”	238
“Shaping the Web: Why the politics of search engines matters”	311	3	2000	“INFORMATION SOCIETY”	27
“Older adults' use of information and communications technology in everyday life”	296	3	2003	“AGEING & SOCIETY”	111
“Comparing internet and mobile phone usage: digital divides of usage, adoption, and dropouts”	294	7	2003	“TELECOMMUNICATIONS POLICY”	153
“Understanding digital inequality: Comparing continued use behavioral models of the socio-economically advantaged and disadvantaged”	289	13	2008	“MIS QUARTERLY”	201
“The Internet and knowledge gaps - A theoretical and empirical investigation”	286	12	2002	“EUROPEAN JOURNAL OF COMMUNICATION”	89
“Effect of computer support on younger women with breast cancer”	263	0	2001	“JOURNAL OF GENERAL INTERNAL MEDICINE”	20
“eHealth Literacy: Extending the Digital Divide to the Realm of Health Information”	251	22	2012	“JOURNAL OF MEDICAL INTERNET RESEARCH”	193
“The determinants of the global digital divide: a cross-country analysis of computer and internet penetration”	240	12	2007	“OXFORD ECONOMIC PAPERS-NEW SERIES”	89
“Social disparities in internet patient portal use in diabetes: evidence that the digital divide extends beyond access”	224	2	2011	“JOURNAL OF THE AMERICAN MEDICAL INFORMATICS ASSOCIATION”	73
“Digital inequalities and why they	224	45	2015	“INFORMATION	328

matter”				COMMUNICATION & SOCIETY”	
“The digital divide: the special case of gender”	216	4	2006	“JOURNAL OF COMPUTER ASSISTED LEARNING”	83

Authorship patterns

On "Digital Divide," the authorship trends range from a single author to a maximum of 21. The study of the total 2430 publications reveals that the most common authorship style was two-authorship, which created a maximum of 735 publication, sum of TC=14229, and Citation impact 19.35918367, Followed by one author 679 publication, sum of TC=9939, and Citation impact 14.6377025. Three authors 520 publication, sum of TC=7591, and Citation impact 14.59807692,, Four authors 239 publication, sum of TC=3032, and Citation impact 12.68619247, Five authors 115 publication, sum of TC=1222, and Citation impact 10.62608696, Six authors 54 publication, sum of TC=1031, and Citation impact 19.09259259, seven authors 27 publication, sum of TC=902, and Citation impact 33.40740741, eight authors 28 publication, sum of TC=500, and Citation impact 17.85714286, nine authors 12 publication, sum of TC=370, and Citation impact 30.83333333, ten authors 5 publication, sum of TC=42, and Citation impact 8.4, eleven authors 5 publication, sum of TC=521, and Citation impact 64.2, twelve authors 1 publication, sum of TC=1, and Citation impact 1, Thirteen authors 4 publication, sum of TC=83, and Citation impact 20.75, fourteen authors 3 publication, sum of TC=36, and Citation impact 12, fifteen authors 2 publication, sum of TC=0, and Citation impact 0, and at the end twenty-firsts authors 1 publication sum of TC=17, and Citation impact 17.

Table 3 Authorship Patterns

Authorship	Count Of authorship	Sum Of TC	citation impact
1	679	9939	14.6377025
2	735	14229	19.35918367
3	520	7591	14.59807692
4	239	3032	12.68619247
5	115	1222	10.62608696
6	54	1031	19.09259259
7	27	902	33.40740741
8	28	500	17.85714286
9	12	370	30.83333333
10	5	42	8.4
11	5	321	64.2
12	1	1	1
13	4	83	20.75
14	3	36	12
15	2	0	0
21	1	17	17
	2430		

Most productive countries

The affiliation of authors is used to determine the origin of articles, and the contribution of the first author is considered the most important contribution to the work. A total of 1632 papers were published from different countries. In given table top countries are arranged according to number of publications, According to the report, the United States ranks first with 780 (TC = 20832), followed by the United Kingdom 186 (TC = 4406), Spain 161 (TC = 1222), China 133 (TC = 1721), Australia 96 (TC = 105), Canada 82 (TC = 1517), Netherlands 73 (TC = 3565), Italy 72 (TC = 10108) Germany 64 (TC = 916) and South Africa 62 (405). South Korea 57 (TC=532), Taiwan 55 (TC=422), India 51 (TC=220), Malaysia 46 (TC=92), Japan 38 (TC=391), Mexico 37 (TC=397), Norway 34 (TC=632), Sweden 33 (TC= 541), Russia 31 (TC=43) and Brazil 30 (TC=152). (See Table).

Table 4 Most Productive Countries

Country	Documents	Citations
U.S.A	780	20832
England	186	4406
Spain	161	1222
China	133	1721
Australia	96	1005
Canada	82	1517
Netherlands	73	3565
Italy	72	767
Germany	64	916
South Africa	62	405
South Korea	57	531
Taiwan	55	422
India	51	220
Malaysia	46	92
Japan	38	391
Mexico	37	397
Norway	34	632
Sweden	33	541
Russia	31	43
Brazil	30	152

Most Productive organizations

Given Table lists the top twenty organizations that publish research on "Digital Divide". Tilburg University is on top with 26 publications, 398 Citations and 15.307 Citation impact, followed by University Kwente with 24 publications, 2586 Citations and 107.75 citation impact, Oxford University with 24 publications, 641 citations and 26.708 citation impact, Michigan state University with 23 publications, 850 Citations and 36.956 citation impact, University of Wisconsin with 22 publications, 888 citations and 40.363 citation impact, Penn state University with 21 publications, 382 citations and 18.190 citation impact, University of Washington with 20

publications, 466 citations and 23.3 citation impact, University of Maryland with 19 publications, 777 citations and 40.894 citation impact, Rutgers state University with 19 publications, 669 citations and 35.210 citation impact, University of Texas Austin with 17 publications, 498 citations and 29.294 citation impact, Arizona state University with 17 publications, 241 citations and 14.176 citation impact, University of Complutense Madrid with 17 publications, 73 citations and 4.235 citation impact, University of Liubliana with 16 publications, 209 citations and 13.063 citation impact, Temple University with 16 publications, 627 citations and 39.187 citation impact, Indiana University with 16 publications, 296 citations and 18.5 citation impact, University of Illinois with 15 publications, 446 citations and 32.733 citation impact, University of Seville with 14 publications, 84 citations and 6 citation impact, University of Turku with 14 publications, 158 citations and 11.285 citation impact, Nanyang technical University with 12 publications, 120 citations and 10 citation impact, And Florida state University with 11 publications, 456 citations and 41.454 citation impact. It's also worth mentioning that Florida State University (41.454) and University of Maryland (40.894) have highest citation impact.

Table 5 Most Productive Organizations

Organization	Count Of organization	Sum Of TC	CI
Tilburg Univ	26	398	15.307
UniKwente	24	2586	107.75
Univ Oxford	24	641	26.708
Michigan State Univ	23	850	36.956
Uni Wisconsin	22	888	40.363
Penn State Univ	21	382	18.190
UNIV WASHINGTON	20	466	23.3
UNIV MARYLAND	19	777	40.894
Rutgers State Univ	19	669	35.210
Univ Texas Austin	17	498	29.294
ARIZONA STATE UNIV	17	241	14.176
UNIV COMPLUTENSE MADRID	17	72	4.235
UNIV LJUBLJANA	16	209	13.062
TEMPLE UNIV	16	627	39.187
INDIANA UNIV	16	296	18.5
UNIV ILLINOIS	15	446	29.733
UNIV SEVILLE	14	84	6
UNIV TURKU	14	158	11.285
NANYANG TECHNOL UNIV	12	120	10
FLORIDA STATE UNIV	11	456	41.454

Most Productive Authors

The top 20 most prolific authors on "Digital Divide" are listed in the table, along with their first year of publication, total publications and total citations. Many of the famous writers have published somewhere between 23 and 6 articles. There are five authors have over 10 publications (listed in table). James j is the most prolific author, with 23 publications, 376 citations, 19 g-index, 12 h-index and 0.571 m-index, Followed by Van Deursenajam with 19 publications, 1414 citations, 19 g-index and 14 h-index , Cotton SR with 13 publications, 876 citations, 13 g-index, 8 h-index and 0.444 m-index, Van DijkJagm with 13 publications, 1770 citations, 13 g-index, 10 h-index and 0.625 m-index, Kvasny L with 12 publications, 216 citations, 12 g-index, 7 h-index and 0.333 m-index, Cruz-Jesus F with 9 publications, 207 citations, 9 g-index and 6 h-index, Robinson L with 9 publications, 288 citations, 9 g-index, 5 h-index and 0.455 m-index, Oliveira T with 8 publications, 206 citations, 8 g-index and 6 h-index, Park S with 8 publications, 65 citations, 8 g-index, 3 h-index and 0.25 m-index, Razak NA with 8 publications, 6 citations, 2 g-index, 1 h-index and 0.077 m-index, Dhalin ZM with 7 publications, 21 citations, 4 g-index, 2 h-index and 0.167 m-index, Hilbert M with 7 publications, 356 citations, 7 g-index, 6 h-index and 0.5 m-index, Lutz C with 7 publications, 104 citations, 7 g-index, 5 h-index and 0.714 m-index, Pick JB with 7 publications, 140 citations, 7 g-index, 5 h-index and 0.294 m-index, Rasheva-Yordanova K with 7 publications, 6 citations, 2 g-index, 1 h-index and 0.167 m-index, Rikard RV with 7 publications, 51 citations, 7 g-index, 5 h-index and 0.714 m-index, Bacao F with 6 publications, 180 citations, 6 g-index, 4 h-index and 0.364 m-index, Blank G with 6 publications, 221 citations, 6 g-index, 6 h-index and 0.6 m-index, Dwivedi YK with 6 publications, 68 citations, 6 g-index, 3 h-index and 0.3 m-index and it is noted that Hargittai E have last position in table with 6 publications, 826 citations, 6 g-index, 6 h-index and 0.375 m-index.

Table 6 Most productive Authors

Author	h_index	g_index	m_index	TC	NP	PY_start
JAMES J	12	19	0.571	376	23	2001
VAN DEURSEN AJAM	14	19		1414	19	2009
COTTON SR	8	13	0.444	876	13	2004
VAN DIJK JAGM	10	13	0.625	1770	13	2006
KVASNY L	7	12	0.333	216	12	2001
CRUZ-JESUS F	6	9		207	9	2011
ROBINSON L	5	9	0.455	288	9	2011
OLIVEIRA T	6	8		206	8	2011
PARK S	3	8	0.25	65	8	2010
RAZAK NA	1	2	0.077	6	8	2009
DAHALIN ZM	2	4	0.167	21	7	2010
HILBERT M	6	7	0.5	356	7	2010
LUTZ C	5	7	0.714	104	7	2015
PICK JB	5	7	0.294	140	7	2005
RASHEVA-YORDANOVA K	1	2	0.167	6	7	2016
RIKARD RV	5	7	0.714	51	7	2015
BACAO F	4	6	0.364	180	6	2011
BLANK G	6	6	0.6	221	6	2012

DWIVEDI YK	3	6	0.3	68	6	2012
HARGITTAI E	6	6	0.375	826	6	2006

Keywords Analysis

The keywords of frequently used authors in “Digital Divide” are highlighted in Figure. VOSviewer software was used to conduct the keyword analysis. Only 70 keywords out of 5127 reach the threshold since the minimum number of 14 keyword occurrences is chosen. The number of keyword occurrences and associational connections are indicated by the distance and size of the bubble. More than 2387 times, the top five keywords were used. The keyword “Digital Divide” occurs 1848 times, followed by “Internet” which appears 269 times, “ICT” which appears in 135 publications, “Digital Inequality” which appears in 68 publications, and “Digital Literacy” which appears 67 times. These 70 keywords were grouped into seven clusters by VOSviewer. Cluster one has 13 items Accessibility, Adoption, Big Data, Digital Divide, Disability, E-commerce, Elderly, Innovation, Older People, Privacy, Social media, Usability and Youth. Cluster two has 12 items including China, Developing countries, Development, Gender Digital Divide, ICT4d, ICTS, India, Information and communications technology, Information technology, Mobile phones, Policy, Telecommunications. Cluster three has 11 items including Computer Literacy, Digital inequality, Digital Literacy, Digital skills, Digitalization, Information literacy, Internet skills, Internet use, Media literacy, Older Adults, and social inequality. Cluster four has 10 items including Access, Africa, E-health, Inequality, Information, Internet, Mobile phone, Social capital, Social exclusion and Technology. Cluster five has 9 items including Broadband, Computers, Gender, Information communication and technology, Internet access, Internet usage, race, rural and rural areas. Cluster six has 8 items including Covid-19, Digital inclusion, Digital inequalities, E-learning, Education, Higher education, Social inclusion and Young people. Cluster seven has 7 items including E-democracy, E-government, E-inclusion, European Union, ICT, Information society and Technology Adoption.

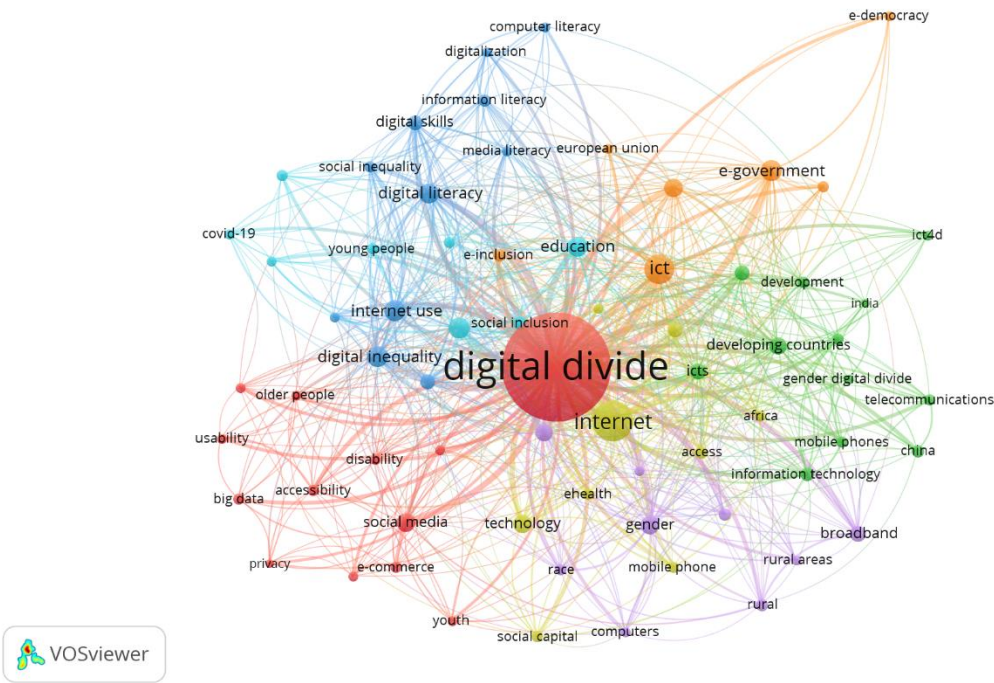


Figure 1 Keywords Analysis

Document types

There were 2443 documents that met the selection requirements in particular. Article (1632) was the most common form of publication in these 2443 publications, accompanied by Proceeding paper (718), Review (39) Book Chapter (3) and early access (36). The most occurring document like Article, It was the Core Collection of the Web of Science (TC=35211), Proceeding paper (TC=1991), Review (TC=2055), Book Chapter (TC=20) and Early access have (TC=39).

Table 7 Document types

Document Type	Total Publications	Total Citations	Citation impact
ARTICLE	1632	35211	21.575
Proceeding paper	718	1991	1.206
Review	39	2055	17.75
Book chapter	3	20	52.692
early access	36	39	1.083

World collaboration

Given table present the Country collaboration and given figure shows the collaboration of countries map on “Digital Divide”. There are 187 entries among the various countries worldwide with maximum of 33 one collaboration. The United State and China have most of all 33

collaboration, Followed by United Kingdom and United State with 21 collaboration, United State and Canada with 21, United State and Korea with 13, United State and Germany with 10, United State and Australia with 9, United Kingdom with Netherlands 8, United State with Singapore 8, Ecuador with Spain 7, United Kingdom with Canada 7, Switzerland with Germany 6, United State with Chile 6, United State with Italy 6, United Kingdom with Italy 5, United State with Brazil 5, United State with Japan 5, United State with Mexico 5, Australia with Canada 4, Australia with China 4 and at the end the lowest collaboration of China with South Africa is 4. We can clearly see in the table that United State is the country which have collaboration with 11 countries which is most of all.

Table 8 World Collaboration

From	To	Frequency
USA	CHINA	33
UNITED KINGDOM	USA	21
USA	CANADA	21
USA	KOREA	13
USA	GERMANY	10
USA	AUSTRALIA	9
UNITED KINGDOM	NETHERLANDS	8
USA	SINGAPORE	8
ECUADOR	SPAIN	7
UNITED KINGDOM	CANADA	7
SWITZERLAND	GERMANY	6
USA	CHILE	6
USA	ITALY	6
UNITED KINGDOM	ITALY	5
USA	BRAZIL	5
USA	JAPAN	5
USA	MEXICO	5
AUSTRALIA	CANADA	4
AUSTRALIA	CHINA	4
CHINA	SOUTH AFRICA	4

Country Collaboration Map

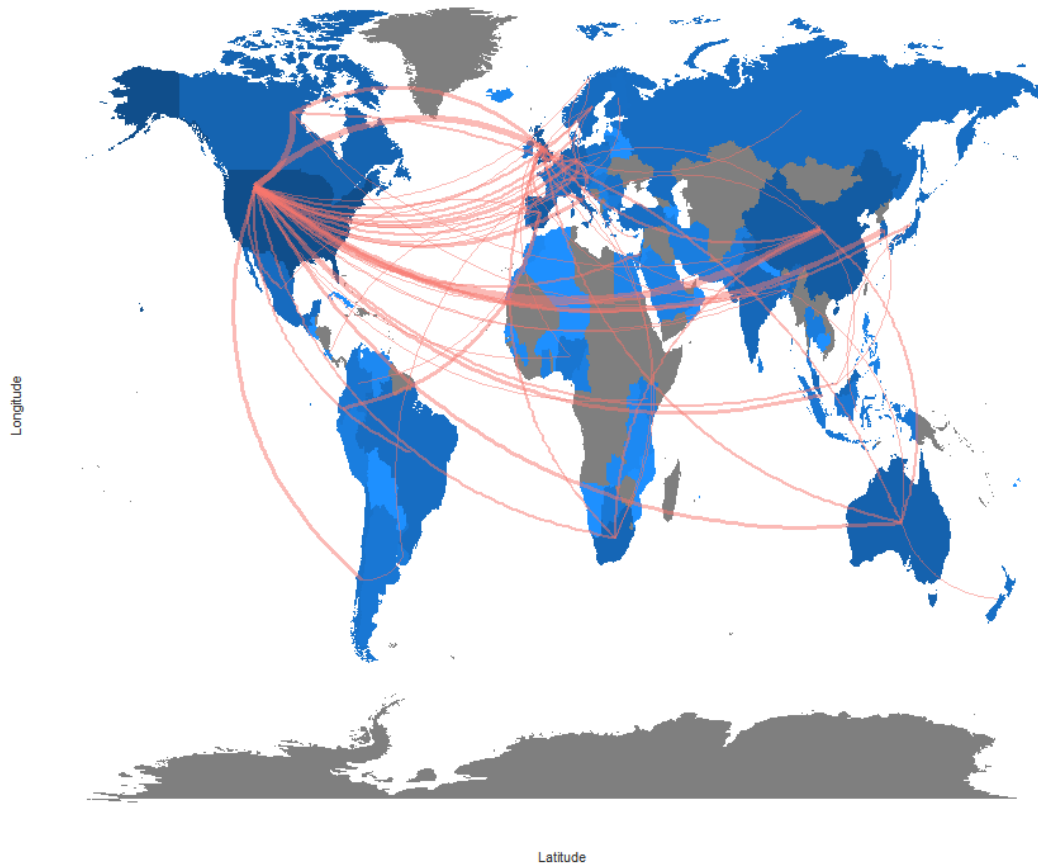


Figure 2 Country Collaboration Map

Three Factor analysis

Countries, author and keywords

The top 20 Countries, author and keywords in the literature of “Digital Divide” were used to create a three-factor diagram. The block's size indicates the intensity of each factor's association. Top Countries (USA, Netherlands, United Kingdom, Malaysia, Portugal, Spain, Australia), have maximum authors (Vendeursenajam, jams j, cotton sr, park s) who are using the keywords (Digital Divide, Digital, ICT, Internet, Digital inequality). And the blocks on extreme right side shows the links with keywords.

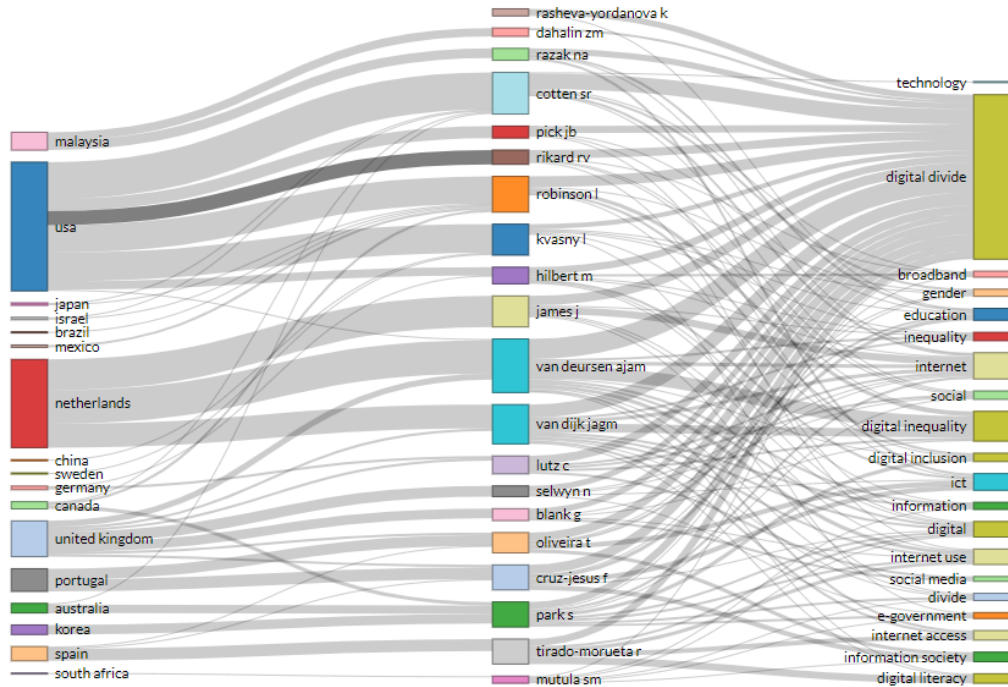


Figure 3 Three field plot Countries (left), Authors (Middle) and Keywords (Right)

Countries, Author and affiliations

The top 20 countries, authors and affiliations in the literature of “Digital Divide” were used to create a three-factor diagram. The block's size indicates the intensity of each factor's association. Top countries (United State, United Kingdom, Netherlands, Spain, Australia, Canada, Malaysia) have strong relation with authors (Vendeursenajam, jams j, cotton sr, park s) and the extreme right side the blocks shows the links with organizations (University of twente, Arizona State University, Tilburg University, Michigan State University, Penn State University).

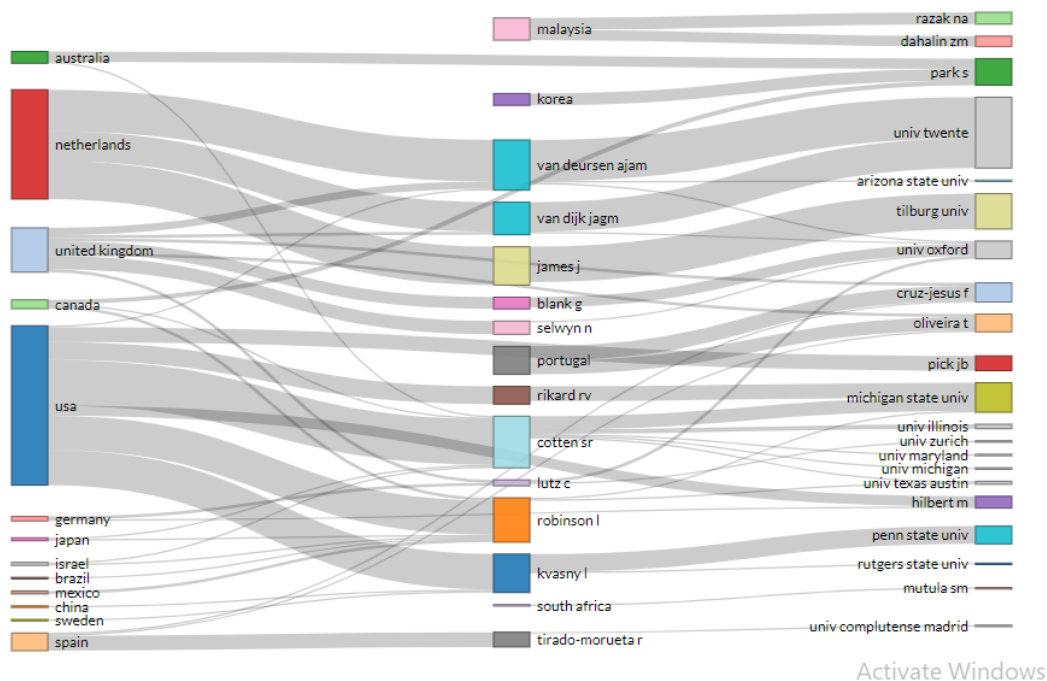


Figure 4 Three field plot Countries (left), Authors (Middle) and Affiliations (Right)

Limitations of the study and Future Research Guidelines

The scope of this research was limited to the literature on the "Digital Divide" that was indexed in Web of Science. Second, this report only focused at peer-reviewed journal papers published between 1999 and 2021, a total of twenty-three (23) years. Finally, this study focused solely on literature published in English.

There is a need to perform a systematic inventory of the "Digital Divide" literature indexed by major international databases such as WOS, SCOPUS, Google Scholar, etc. for a variety of literature such as conference proceedings books and papers so that we can gain a better understanding of the phenomenon. New facets of the "Digital Divide" such as Gender divide, social divide and universal access divide required to be investigated in order to get a different perspective on the topic than the pro-western viewpoints.

Conclusion

The research was done with the help of the Web of Science Database's literature. The main aim of this research was to provide a thorough overview of the research on "Digital Divide" that had been done. The study looks at how scientific trends have changed year by year in terms of publications and citations between 1999 and 2021. A total of 2443 publications about "Digital Divide" were written. The most common form of publication (1632) was an article. Nonetheless, based on our analysis and results from the current study, we would like to suggest a few potential research topics for the future. Researchers working in the field of "Digital Divide" will use this analysis to establish strategies based on topics that are emerging (as shown by the data visualization in this study). They should also identify the most influential articles, authors, and journals in this field in order to identify research gaps and new insights. To sum up, this study has contributed significantly to the growing body of knowledge on the "Digital Divide." We

have provided new insights in the “Digital Divide” field by reviewing 2443 published articles, proceeding papers, review, book chapters and early access from Web of Science.

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