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Grey Digital Divide: A Literature Review and Bibliometric Analysis of Digital Divide among Older Adults

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Abstract

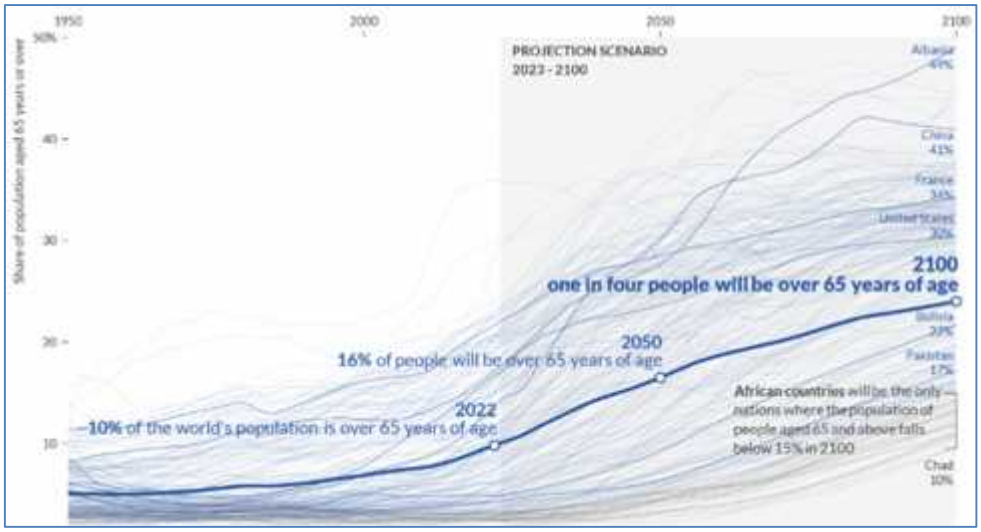
The globe is turning into a grey nation or an aging society. It is a truth that the majority of the nation is dealing with a difficult issue that is unavoidable and has given rise to a brand-new development in the field of information systems known as the grey digital divide. The aim of this study is to understand the present state of research on grey digital divide studies by performing a thorough examination of scientific pro-duction using bibliometric analysis. This study applies step by steps bibliometric analysis technique. All of the data set was obtained from the Scopus databases, and VosViewer, ScientoPy, and Microsoft Excel were utilized as tools for further analysis. Bibliometric analysis was used to find and examine 408 papers that were published between 2001 and 2023.Performance analysis, network analysis, and keyword analysis were among the analyses conducted. This paper makes a substantial contribution to the present knowledge of the grey digital divide by addressing a thorough summary of published work, offers an analysis that can be a direction for future research by pinpointing the main topics and particular domain within grey digital divide research. Our analysis also highlights new topics in the literature on the grey digital gap, such as "digital inclusion", "telehealth", "social isolation", "gerontechnology", and "digital inequality". The study's findings examine research on the grey digital divide, including noteworthy publications, prolific authors, and cross-border partnerships. This study also explores the topic clusters, hot topics and emerging trend in the field and found that the research on the grey digital divide has significantly increased. Finally, the study emphasizes how useful bibliometric analysis especially in identifying areas of unmet research need. The results of this paper can be used by researchers to understand the current status of research on the grey digital divide by highlighting important themes, publications, authors, and key trends. It also emphasizes the usefulness of bibliometric analysis as a tool for understanding research trends and identifying research gaps in the field.

Keywords: Digital Divide; Grey Digital Divide; Older Adults

1. Introduction

The world is becoming an ageing society or grey nation. This is a fact that most of the country is facing the challenging phenomenon which cannot be avoided. The data by United Nation World Population Prospects (United Nation World Population Prospects, 2022) show that 10 percent of the world population is people aged 65 and above. Several countries now in position above the world average such as Canada, European Countries and Japan. It is projected that world population of aged 65 and above will increase to 16 percent in 2050 as highlighted in **Figure 1**. Nevertheless, the figure is increasing year by year. With the increment of the population, several parties such as government, non-government organization and association have to figure out preparation for older adult care especially related new phenomenon in information system field which is grey digital divide. The situation of unequal access to information communications technologies (ICT) either by gender, territory or social class which due to the economic barriers that limit resources and prevent people from obtaining or using newer technologies. The issue always referred as digital divide (digital gap) which means ‘the lack of access to communication technology by some people’ (Davis & Baran, 2011). Shi et al., (Shi et al., 2023) defined digital divide in simple words as the inequalities in Internet access and use. At the social level, digital divide refers to the gap between the majority and minority groups including (1) low-income residents, (2) ethnic minorities, (3) rural communities, (4) older adults, (5) the disabled, and (6) women (Kuttan & Peters, 2003; Kwong, 2015).

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Source: (United Nation World Population Prospects, 2022)

Figure 1: Population Aged 65 and Above.

With the use of bibliometric analysis, the goal of this study is to offer an extensive overview of re-search topics and trends based on keywords, as well as publication output based on journals and authors related to the grey digital divide. Additionally, it aims to show how beneficial bibliometric analysis is as a research tool. Based on this, this study tries to answer these five questions:

Q1. What are the most contributing sources to grey digital divide research?

Q2. Which authors and countries have actively contributed to grey digital divide research?

Q3. What are the most important cited articles that contribute to the body of knowledge in grey digital divide research?

Q4. What are the research clusters related to grey digital divide research?

Q5. What are the hot research topics and emerging trends in grey digital divide research?

In order to investigate these issues, we used bibliometric techniques and cloud word for emerging trends to analyse 408 publications on the grey digital divide that have been published in the Scopus database since 2001.

2. Literature Review: Grey Digital Divide

World is facing a phenomenon called as grey digital divide or digital divide among older adults. For example, according to a recent Korean national statistical index, the digital divide among older people in South Korea is more serious than the general public (Jun, 2020). In Taiwan as well, based on Wang and Wu (Wang & Wu, 2022), the rate of ownership of mobile phone among older adult in Taiwan is higher than internet access showing that they still used mobile phone traditionally. So, the grey digital divide is increasing and consider as a social problem (Fung et al., 2023; Jun, 2020; Min, 2020). Based on World Health Organization in 1990, they adopted “healthy aging” as a development strategy as a response to the challenges of aging population (Guo & Zhu, 2022). Ac-cording to Niehaves and Plattfaut (2014) the elderly people (65 years of age and older) are significantly less likely to use the Internet compare to the average population. The diffusion rate among the elderly is increasing, but will continue to lag behind the figures of the young users (Paul & Stegbauer, 2005). As comparison, according to Fung et al. (2023) youth, male, well educated, living with others, and higher self-perceived social class were associated with material access to digital devices and everyday use of Internet services. In reality, grey digital divide is growing in Malaysia. MCMC’s Internet Users Survey 2020 has the answer when the result shows that, the older adults in Malaysia are embracing modern technology more compared to previous years. However, Internet usage among the elderly age 65 and above has declined from 12.6 per cent in 2018 to 11.3 per cent in 2020 and more than half of the non-Internet users are 60 years old and above (51.8 per cent) (TM R&D, 2022). It indicates that while the whole world goes digital, senior citizens who are not tech savvy are getting left behind and facing barriers to access and services (Balasegaram, 2023). Additionally, by 2040, Malaysia has an ageing demographic of 15 per cent predicted to be 65 years of age or older (Department of Statistics Malaysia, 2017). This age

group has high probability of being associated with memory disorder is-sues. Dementia is among a popular problem that has been diagnosed for this age group. Dementia treatment encompasses both pharmacological and non-pharmacological interventions.

Shi et al. (2023) divided digital divide into two levels which are internet access as first level and digital skill as second. In Chine, research shows that 45.52% of older adults still have problem in first level digital divide. It is seen that bridging the grey digital divide can helps improve health, social interaction and wellbeing. Third level of digital divide indicates the emergence of digital benefit (Tokés, 2022). The combination of level is so called as digital inequalities. Technology could provide older adults with more information, help them to cope with the challenges of living in a modern and sophisticated world and enhance their communication with their loved ones. These would assist them in reducing social isolation and improving the quality of their life (Ibrahim et al., 2022). By adapting to digital world, older adult can gain knowledge on digital society, improve digital skill, interaction to technology and society and changing their life (Cheng et al., 2022). In daily life of the older adults, it is inconvenience so that they cannot fully enjoy the convenience brought by digital and intelligent services, causing that they are excluded from the digital society, and become "digital survivors" or "digital refugees". Development of a "digital-friendly" aging system or application is an essential (Liu et al., 2021).

3. Research Perspectives of Grey Digital Divide.

Research in grey digital divide can be in several categories or perspectives such as psychology (Min, 2020), health (Fung et al., 2023; Liu et al., 2022), education (Cheng et al., 2022), social (Friemel, 2016; Guo & Zhu, 2022; Kwong, 2015; Marimuthu et al., 2022; Nishijima et al., 2017; Shi et al., 2023; Tokés, 2022; Wang & Wu, 2022) and information system (Blažič & Blažič, 2020; Jun, 2020; Levy et al., 2015a; Niehaves & Plattfaut, 2014). In health perspective, researchers found that older adults who used internet or access to digital had higher self-rate mental and physical health (Fung et al., 2023) and social support from relatives and pears (Liu et al., 2022). Researchers in social perspective have found several outstanding outcomes. The study on the impact of digital divide on active ageing have found that the grey digital divide inhabits active ageing, and improve interaction (Guo & Zhu, 2022; Shi et al., 2023; Wang & Wu, 2022). They also study causes and sequences of grey digital divide and highlight several causes such as inadequate motivation, access, digital skill, usage (Kwong, 2015), and lack of education (Nishijima et al., 2017). Researches in IS/IT perspective explore the device and its usage (Blažič & Blažič, 2020), and inter-net adoption (Levy et al., 2015a; Nishijima et al., 2017). Researches also looked at the angle of unequal access to information communication technology. One of the factors is the difficulty for older adult especially in rural areas to switch from the traditional media such as television to newer technology such as social networking (Singh & Cullinane, 2010). It has been a convenient day to get a device and internet access, but everyone is moving across the digital gap is experiencing many problems. The key concern is the question of exposure to the mental obstacle, in particular the elderly (Rahaman & Rahaman, 2020). Restricted exposure and poor technology literacy are main factors for preventing older adults from complete participation in the mod-ern environment (Ma et al., 2020). This circumstance can be seen in Malaysian community, especially for those older adults who have less opportunity to interact with technology.

Older adult citizens are gradually embracing technology such as computers, the internet and mobile media (Duh et al., 2010). Mobile apps are, thus, rapidly becoming personal objects for them (Duh et al., 2010). Hence, adding games on appropriate mobile devices would enable them on play games that will help develop their health - care and neurological reflexes. Rautenberg (2004) and Chin et al. (2017) notes that film technology has beneficial impacts on human behaviour, such as: capacity to read, healthy social contact and healthcare. A digital divide persists, given the improved convenience of utilizing electronic tools for older adults. Based on literature review analysis, re-searchers in IS/IT perspective were still influenced by social science type of research. The development of digital friendly ageing applications is still inadequate.

4. Methodology

Digital information system research covers many themes and aspects of people's life, such as digital adoption (Hadi et al., 2020, 2021; Taufiq-Hail et al., 2021; Trawnih et al., 2023), digital inclusion (Hoyos Muñoz & Cardona Valencia, 2023), digital wellbeing (Ghai et al., 2023), digital literacy (Wang & Si, 2023a), and the digital divide (Lythreatis et al., 2022). This study, however, focuses on the grey digital divide, which is a sub-theme under the digital divide. The content of research article can be studied using a qualitative or quantitative. Both of them ex-amine the material on certain subjects that can be found in electronic databases like Scopus and Web of Science (WoS). Quantitative research on research papers reveals that bibliometric and scientometric analysis are the two most often used methods of analysis. But additional methods like infometric, netometric, webometric, and cybermetric are also employed. Bellis (Bellis, 2009) asserts that bibliometrics emphasizes on the material component of the research by measuring academic writing products, publications, citations, and any statistically significant manifestation of recorded data across all discipline boundaries.

Scientometrics, on the other hand, is ultimately concerned with the quantitative and comparative assessment of the contributions made by individuals, groups, institutions, and nations to the field of knowledge. Scientometric comparative evaluation has attracted researches in information system such as in information sharing (Madlberger & Roztocki, 2009; Omar & Kasiran, 2018) and information system project management (Pollack & Adler, n.d.). Bibliometric also emerge in main stream of information system fields such as digital literacy (Baber et al., 2022; Wang & Si, 2023b), digital wellbeing (Ghai et al., 2023), information system adoption (Cobelli & Blasioli, 2023) and digital transformation (Lialestani et al., 2021). For this study we use the bibliometric analysis as a method to establish the foundation for the subject being investigated.

5. Bibliometric Analysis

Bibliometrics is the branch of information and library sciences that does quantitative analysis of bibliographic data (Mas-Tur et al., 2020). Meanwhile, the phrase "bibliometric analysis" refers to a quantitative measurement used to ascertain the amount and trends of literature growth in a specific new topic of study. It covers the analysis of performance and scientific mapping (Wang & Si, 2023b). Bibliometric analysis is an approachable and useful method for comprehending and map-ping the cumulative scientific knowledge and evolutionary intricacies of well-established disciplines because it makes rigorous sense of enormous volumes of data (Donthu et al., 2021). In this study, we categories our analysis into three main analyses; performance analysis, network analysis and key-words analysis. Performance analysis assessed how well the publications performed in terms of their sources of contribution, scientific production, productive authors and high citation. Network analysis highlights the crossed-border collaboration. meanwhile keywords analysis focusses on the trend and growth of keywords. These three analyses were combined to present the topic under study's intellectual structure and bibliometrics.

6. Data Source

The scientific literature was gathered using the Scopus database in order to fully cover global research on the grey digital divide. The Scopus database was chosen because of it positioned as the largest abstract and indexing database (Ahmi et al., 2019), the largest searchable source of citations, abstracts for literature searches (Chadegani et al., 2013), the largest database of abstracts, citations for peer-reviewed literature, and its ability to offer a thorough summary of all research output produced worldwide (Ahsan et al., 2022; Wahid et al., 2020). The data was extracted on November 16, 2023. Scopus ranks worldwide conferences and indexes high-quality papers from leading journals for the topic of grey digital divide. In retrieving the data, query for searching is an important aspect. So, the query used was: “Digital Divide” AND “Older Adults” OR “Grey Digital Divide” OR “Age-Based Digital Divide” OR ‘Elderly”.

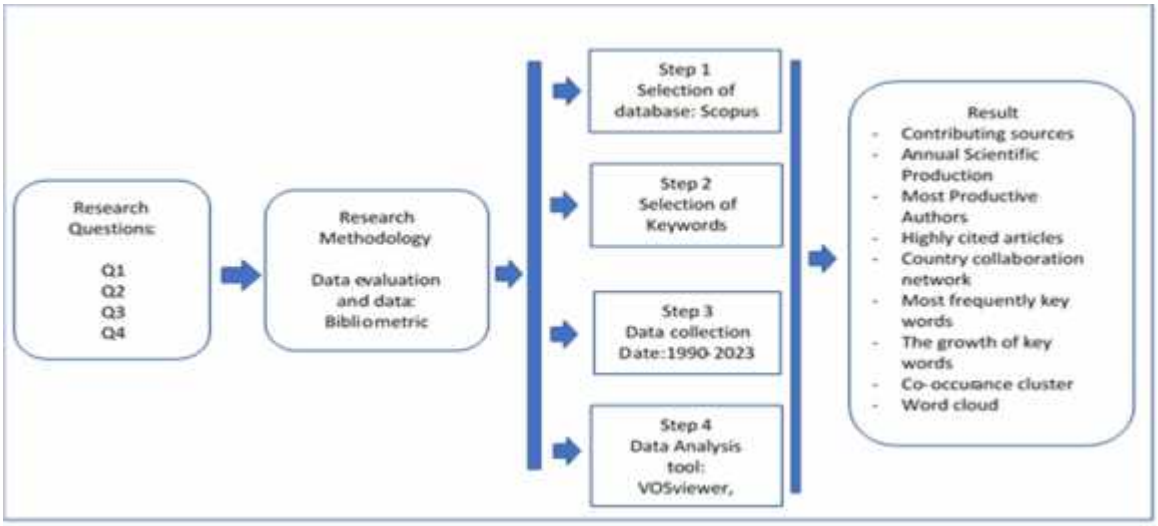


Figure 2: Phases of Bibliometric Analysis for Grey Digital Divide

These search terms were employed subsequent to the results of an earlier tabulation study. A more focused search was conducted, and documents between 1990 and 2023 in terms of publication date were chosen. Comprehensive article details were included in the data that was taken from Scopus. A total of 408 articles for literature data were retrieved from the Scopus database. We extracted comprehensive records from all 408 papers, including the abstract and cited references, including the author name, affiliation, year of publication, journal name, title, category, and references.

Figure 2 depicts each step of the bibliometric analysis process, including database selection, data retrieval, and additional analysis.

This study utilized VosViewer version 1.6.19 (van Eck & Waltman, 2023), which is a free software package developed by Nees Jan van Eck and Ludo Waltman from Universiteit Leiden and ScientoPy version 2.1.2 (Ruiz-Rosero et al., 2019) a Phyton based tool from Universidad del Cauca, Colombia. Through the use of chart presentations, VosViewer offers non-programmers a graphical interface for doing thorough analysis. Although ScientoPy may also provide charts, we exclusively employed word clouds and used ScientoPy processed data for this investigation. Microsoft Excel was then used to analyse the data.

7. Performance Analysis

The yearly scientific papers, as illustrated in **Figure 3**, provide significant perspectives on the progress made in the field of grey digital divide research. As shown in the figure, the production of the papers began in 2001 with a journal article and a review document. The number of publications on the grey digital gap has grown yearly since its interception, with an average growth rate (AGR) of 4 documents and Average Document per Year (ADY) of 40.2 papers. To be more specific, the ADY for each document is 13.4, while the AGR for the journal article, conference, and review are 3.2, 0.6, and 0.2, respectively. This growth has surged recently, as evidenced by our search, which turned up 81 publications in total in 2023. It is anticipated that this figure will exceed the 78 publications that were published in 2022. There will likely be additional publications in the fields in 2023 with an extra month. In order to understand this trend, it is vital to look at all papers' primary sources. The main sources used in the papers are analysed separately in **Table 1**. The top primary sources were sorted into four broad categories: gerontology (four journals), health Information system (three journals), public health (two journals), and information technology for human and society (five journals).

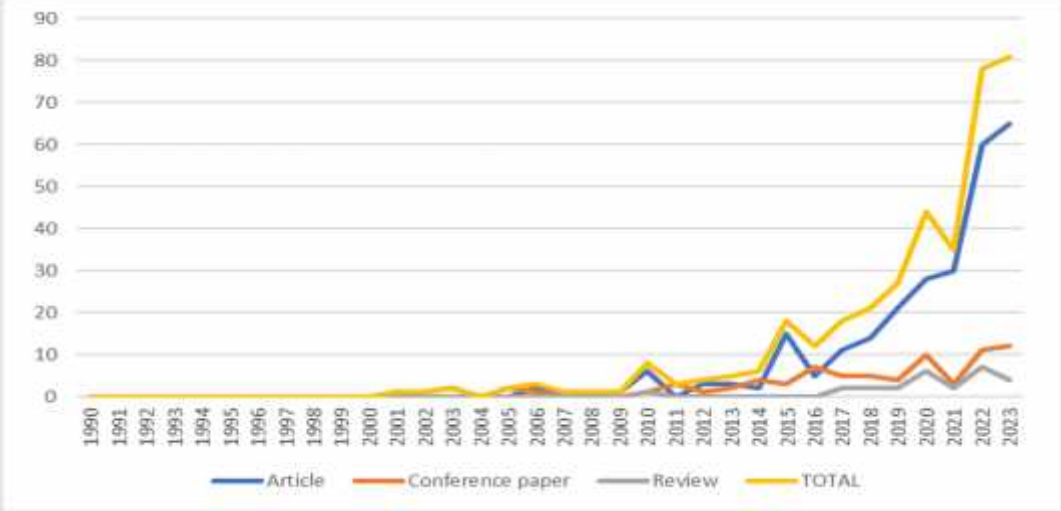


Figure 3: Annual Scientific Production

Journal of Applied Gerontology was the top contributing source for the gerontology category of journals, with sixteen papers and an ADY of 0.8 papers. The journal was regarded as the leading source of contributions across all categories as well. The journal with the least contribution under this category, Gerontologist, had five papers with an ADY of 0.2. The Journal of Medical Internet Research, with eleven papers and an ADY of 0.6, was the best in the field of health information systems. JMIR Aging, with seven pieces and an ADY of 0.4, came second. Meanwhile, Computer in Human Behavior published seven related papers with an ADY of 0.4 under the information technology for human and society category. The journal Technology in Society has four published papers listed as well. In addition, in terms of journal citation index, The Journal of Applied Gerontology has the greatest H index (11), ranking best among journals cited.

Table 1: Top Contributing Sources

Journal	Total	AGR	ADY	H Index
Journal of Applied Gerontology	16	0	0.8	11
Educational Gerontology	11	0.2	0.6	6
Journal of Medical Internet Research	11	0.1	0.6	7
Frontiers in Public Health	9	0.2	0.4	3
Gerontechnology	9	0	0.4	3
International Journal of Environmental Research and Public Health	8	0.2	0.4	4
Computers in Human Behavior	7	0	0.4	6
JMIR Aging	7	0	0.4	4
Conference on Human Factors in Computing Systems - Proceedings	6	0	0.3	5
New Media and Society	6	0	0.3	3
Ageing and Society	5	0.1	0.2	4
Digital Health	5	0.2	0.2	2
Gerontologist	5	0	0.2	5
Technology in Society	4	0	0.2	3

AGR- Average Growth Rate ADY- Average Document per Year

The most prolific writers who have contributed to the study of grey digital divide are included in **Table 2**. The first three authors had published more than five articles, namely, Cotton S. R. with eight articles, Boot W.R and Seifert A. with six articles respectively. The average document per year (ADY) and H index values are also displayed in the table. The table displays each author's average growth rate value in addition to the AGR and H index. Among the authors, Misoch S. and Zhang Y. received AGR value 0.2 respectively.

Table 2: Most productive Authors in Grey Digital Divide

No.	Author	Total	AGR	ADY	H Index
1	Cotten S.R.	8	0.1	0.4	6
2	Boot W.R.	6	0	0.3	3
3	Seifert A.	6	0	0.3	5
4	Aguaded-Gomez J.I.	5	0.1	0.2	4
5	Choudrie J.	5	0	0.2	4
6	Misoch S.	5	0.2	0.2	1
7	Munteanu C.	5	0	0.2	4
8	Tirado-Morueta R.	5	0.1	0.2	4
9	Alvarez-Arregui E.	4	0.1	0.2	3

No.	Author	Total	AGR	ADY	H Index
10	Charness N.	4	0	0.2	4
11	Ortiz-Sobrino M.A.	4	0.1	0.2	3
12	Rikard R.V.	4	0	0.2	4
13	Rodriguez-Martin A.	4	0.1	0.2	3
14	Sixsmith A.	4	0	0.2	4
15	Zhang Y.	4	0.2	0.2	2

AGR- Average Growth Rate ADY- Average Document per Year

Articles that receive a lot of citations are often those with strong academic merit and considerable professional impact (Wang & Si, 2023b). The top fifteen most cited research publications in the area of grey digital divide are shown in **Table 3**. Accordingly, the large number of citations illustrates the journals' impact in this area of study (Donthu et al., 2021). The citations pertaining to the study's current theme demonstrate the field's increasing significance.

The table list the 15 documents on grey digital divide that are most often cited, based on the number of times each was cited together with title of document and journal name. These are the top four publications that have been cited in more than 200 articles. The paper by Choi and DiNitto (2013), published in the Journal of Medical Internet research, has been quoted in 458 articles. Meanwhile, the paper by Selvyn et al. (2003), published in the Ageing and Society journal, has been cited in 439 articles. This paper was published in the early stages of the field of the grey digital divide. Remarkably, Hunsaker and Hargittai's (2018) review paper, which was published in the New Media and Society magazine, was also included in the list of the most highly cited articles. The fourth paper was written by Hill et al. (2015) and it was printed in the Computer in Human Behavior journal. This work essentially investigates older adults' perception of digital technology and has been cited in 247 other articles.

Table 3: Top 15 most highly cited articles

No	Title	Journals	Cited by	Reference
1	The digital divide among low-income homebound older adults: Internet use patterns, e-health literacy, and attitudes toward computer/internet use	Journal of Medical Internet Research	458	(Choi & DiNitto, 2013)
2	Older adults' use of information and communications technology in everyday life	Ageing and Society	439	(Selwyn et al., 2003)
3	A review of Internet use among older adults	New Media and Society	350	(Hunsaker & Hargittai, 2018)
4	Older adults experiences and perceptions of digital technology: (Dis)empowerment, wellbeing, and inclusion	Computers in Human Behavior	247	(Hill et al., 2015)
5	Older Adults' Internet Use for Health Information: Digital Divide by Race/Ethnicity and Socioeconomic Status	Journal of Applied Gerontology	178	(Yoon et al., 2020)
6	Health Literacy and the Digital Divide Among Older Americans	Journal of General Internal Medicine	169	(Levy et al., 2015b)
7	Digital inclusiveness - Longitudinal study of internet adoption by older adults	Journal of Management Information Systems	169	(Lam & Lee, 2006)

No	Title	Journals	Cited by	Reference
8	Old dogs, new clicks: Digital inequality in skills and uses among older adults	Canadian Journal of Communication	165	(Hargittai & Dobransky, 2017)
9	Internet use and non-use: Views of older users	Universal Access in the Information Society	154	(Morris et al., 2007)
10	Getting Grandma Online: Are Tablets the Answer for Increasing Digital Inclusion for Older Adults in the U.S.?	Educational Gerontology	153	(Tsai et al., 2015)
11	Mobile health technology adoption across generations: Narrowing the digital divide	Information Systems Journal	151	(Fox & Connolly, 2018)
12	Reducing the Digital Divide: Connecting Older Adults to iPad Technology	Journal of Applied Gerontology	147	(Delello & McWhorter, 2017)
13	Social Support and Playing Around: An Examination of How Older Adults Acquire Digital Literacy with Tablet Computers	Journal of Applied Gerontology	143	(Tsai et al., 2017)
14	The Digital Divide in Health-Related Technology Use: The Significance of Race/Ethnicity	Gerontologist	133	(Mitchell et al., 2019)
15	Bridging the digital divide in older adults: A study from an initiative to inform older adults about new technologies	Clinical Interventions in Aging	129	(Wu et al., 2015)

8. Network Analysis

In bibliometric analysis, the analysis of collaboration is a crucial component. A cross-border collaboration network analysis is one of the analyses used to examine international partnerships. The partnerships between nations in the study of the grey digital divide are shown in **Figure 4**. The grey digital divide research network currently includes participants from almost every region of the globe. As highlighted, more ticker network nodes are found in the United States, China, and the United Kingdom than in any other country. This suggests that these three countries are in the hub of the collaboration network and that researchers working on the grey digital gap there collaborate more closely. Furthermore, the cooperation network involves Japan, South Korea, and several European countries.



Figure 4: Country Collaboration Network Clusters

9. Keywords Analysis

Table 4 summarizes the most frequently used keywords in grey digital divide studies. Certain terms are believed to have the same reference, such as gander (female and male) and human (human and humans). We also believed that there are parent keywords and child keywords in the classification of key words. As a result, the digital divide was expected to be the most frequently used and popular in the documents, with 244 of the total documents and classified as parent keyword. The rest of the child keywords show up as segments of the research on grey digital divide such as older adults (158), aged (135), and aging (58). Other keywords such as internet, human(s), female, and male are also important, mainly around the grey digital divide concept. In **Figure 5**, the lines show the growth of the key words used in the articles from 2001 to 2023. They show a significant increase in terms of keywords used.

Table 4: Most Frequent key words

No.	Both Keywords	Total
1	digital divide	244
2	Older adults	158
3	human	145
4	aged	135
5	Humans	99
6	article	96
7	female	94
8	male	90
9	Internet	85
10	aging	58

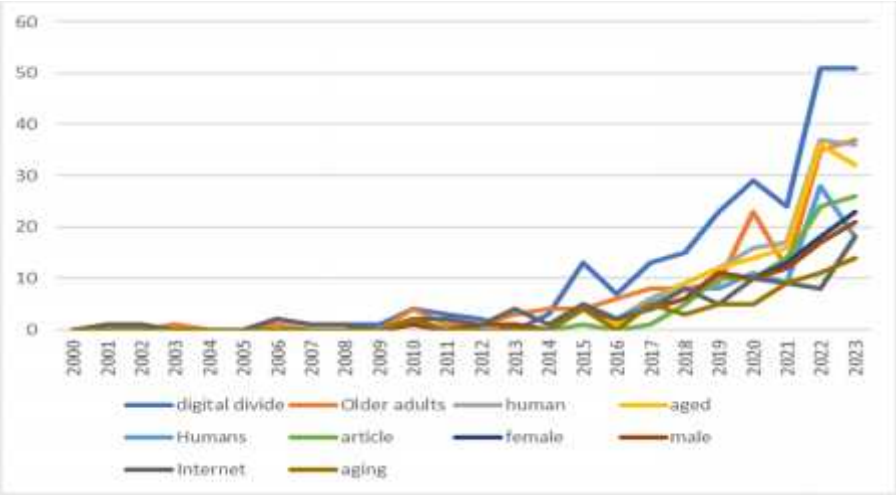


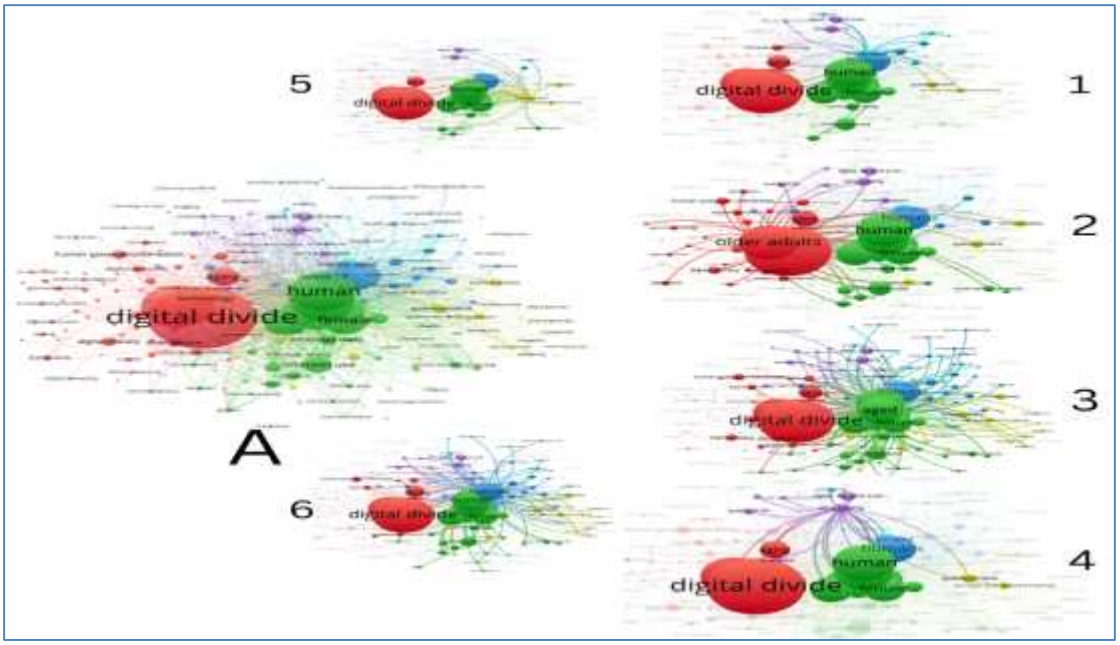
Figure 5: The Growth of keywords

Co-occurrence analysis of keywords, according to Wang and Si (Wang & Si, 2023b) is a helpful method for illustrating the domain space and major material of a particular theme. For this study we consider all keywords which is combining author keywords and index keywords. Author keywords are those that the writers have designated for the document.

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Meanwhile, index keywords are subject headings from the thesaurus of the dataset from which the reference originate (Kraus, 2023).

Figure 6 highlights a co-occurrence cluster of keywords. They represent the primary content and domain space of our study. We have clustered the keywords into six clusters. The primary content for grey digital divide is represented by Cluster A in the figure with the main keyword, digital divide. The rest of the clusters are middle-age, older adults, aged and very elderly, representing domain spaces of the grey digital divide. The other two clusters, questionnaire and human represent the type and aspect of research.



A= All Clusters, 1= Middle Age, 2= Older Adults, 3= Aged, 4= Very Elderly, 5= Questionnaire, 6= Human
Figure 6: Co-Occurrence Clusters

We processed the word clouds derived from the keywords to find emerging themes in the research on digital divide**.** As depicted in **Figure 7**, beside the keywords already mentioned above, Word Cloud also lists the new keywords to represent the emerging themes for the grey digital divide, including “Gerontechnology”, “digital inequality”, “social isolation”, “telehealth”, “digital inclusion”, and “grey digital divide”.

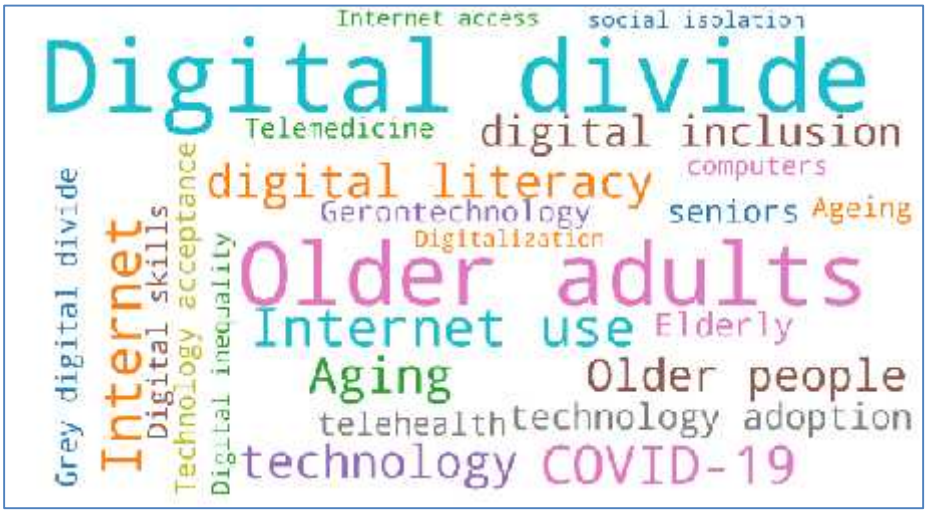


Figure 7: Word Cloud

10. Findings

To sum up, the aforementioned analyses offer a thorough summary of where grey digital divide research is at the moment. The performance analysis, network analysis, and keywords analysis are the three primary analyses of this research that yielded the results of the overview. Our research indicates that there is increasing interest in the grey digital divide, as evidenced by the rise in journal article, review, and proceeding publication numbers. The majority of the publications, according to analysis, are classified as information systems and technology journals. Gerontechnology is the subject of at least four journal publications, the most significant of which being the Journal of Applied Gerontology. Aside from that, the most significant publication in the information system category is the Journal of Medical Internet Research. For the writers who have contributed to the field, authors with the names Cotton S. R., Boot W. R., and Seifert A. are the most prolific. They published more articles and received a high value in average documents per year (ADY). Besides the most influential authors, the most cited papers in articles are also interesting. Our findings indicate that the paper by Choi and DiNitto (2013), published in the Journal of Medical Internet research, the paper by Selvyn et al. (2003), published in the Ageing and Society journal and Hunsaker and Hargittai's (2018) review paper, which was published in the New Media and Society magazine, are among the top most cited articles. Based on cross-border network analysis, our finding depicts that, United Stated, United Kingdom and China are the centre of the research collaboration. However, the collaboration between other nation such as Malaysia, Iran, South Korea and others are also raising. Our keyword analysis indicates that the primary content still tied with digital divide meanwhile, older adult, age and aging are popular keywords chosen to represent grey generation. In terms of usage, all keywords show increment in trend. Finally, word cloud analysis demonstrates the current emerging themes such as “Gerontechnology”, “digital inequality”, “social isolation”, “telehealth”, “digital inclusion”, and “grey digital divide”.

In summary, the present study underscores the need of investigating the grey digital divide in comprehending and tackling the obstacles and prospects faced by the elderly population. Bibliometric analysis offers insights into the most important publications, organizations, and authors and is a useful tool for spotting research gaps and trends. In order to remain relevant, it is crucial to investigate new issues and subjects as the field of grey digital divide study evolves.

11. Discussion

Our work makes a substantial contribution to the present knowledge of the grey digital divide by addressing all five research questions. First, it offers a thorough summary of published work on the grey digital gap in relation to the first three research questions. Researchers and practitioners with an interest in the subject can use this as a reference. Our study makes it easier to find possible partners and research possibilities by highlighting the most well-known authors, publications, and nations that are engaged in grey digital divide studies. Secondly, in response to the fourth question, the co-occurrence network clusters analysis employed in this work provides information about the various facets of research on the grey digital divide. Our study offers an analysis that can direct future research by pinpointing the main topics and particular domain within grey digital divide research. This study can help researchers better understand the various facets of the grey digital divide and tailor their research accordingly. Thirdly, in order to address the fifth research question, our analysis highlights new topics in the literature on the grey digital gap, such as "digital inclusion," "telehealth," "social isolation," "gerontechnology," and "digital inequality." Our work offers options for future research in the grey digital divide by highlighting these developing themes, which can help address the benefits and difficulties resulting from other related phenomena. In Summary, by examining the study as a whole, we show how bibliometric analysis may be used to comprehend research trends and pinpoint research gaps in the grey digital divide. Bibliometric analysis can be an invaluable tool in monitoring the grey digital divide's rapid evolution and informing future research endeavours.

12. Conclusion

As a conclusion, we can say that our study has succeeded in its goal of answering all research questions. It essentially provides a thorough summary of the current status of research on the grey digital divide by highlighting important themes, publications, authors, and key trends. Additionally, it highlights how helpful bibliometric analysis is as a tool for figuring out research gaps and trends in the subject. Furthermore, unexplored research areas like the publishing status of gerontechnology, digital inequality, and social isolation can be examined in future studies. Finally, while this study only examined papers that were indexed in Scopus, it is possible to expand its scope by doing searches in other databases.

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