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Research Trends in Digital Financial Inclusion: A Bibliometric Analysis using VOSviewer

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ABSTRACTS

Digital financial inclusion (DFI) aims to provide affordable and sustainable financial services to financially excluded and underserved populations through cost-saving digital means. The purpose of the study is to conduct a bibliometric analysis of DFI using VOSviewer software. A bibliometric and descriptive quantitative approach was employed. Data was collected based on the keyword "digital financial inclusion" from Google Scholar. From the search results, 982 articles published between 2018 and 2023 were found, with 125 relevant to the topic. The number of DFI publications increased from 7 in 2018 to 18 in 2019, indicating a growing interest. The number remained stable in 2020 and 2021, but there was a significant surge in research interest in 2022 with 37 publications. This study demonstrates the relevance of bibliometric analysis, particularly in the field of DFI. The findings are essential for policymakers, researchers, and practitioners to determine the novelty and quantity of data.

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1. INTRODUCTION

Digital financial inclusion (DFI) has gained significant attention in recent years, signalling a paradigmatic shift in how financial services are accessed and delivered (Yang et al., 2022). DFI has the potential to revolutionize economies and individuals' lives by expanding access to the formal financial system through digital channels, with a particular focus on marginalized groups (Bull & Klapper, 2023). DFI is defined as the use of and access to affordable financial services through digital platforms, such as mobile phones, the Internet, and other digital devices (Demirgüç-Kunt et al., 2020). During the COVID-19 pandemic, DFI was instrumental in facilitating access to essential financial services, such as mobile money transfers, digital payments, and online banking (Ayadi & Shaban, 2020). For example, DFI was used in many countries to support businesses and distribute government aid to vulnerable populations during the pandemic. The study aims to contribute to the existing body of knowledge by conducting a bibliometric analysis of DFI. Bibliometric analysis is a quantitative approach used to examine the relationships between scientific publications. To achieve this, the study utilized the VOSviewer software, which is renowned for its capabilities in mapping and visualizing research trends. The use of VOSviewer is to enable a comprehensive examination of the field, elucidating significant contributions, critical concepts, and emerging research areas (Oladinrin et al., 2023). VOSviewer, a cutting-edge bibliometric analysis tool, empowers researchers to visualize complex networks of scholarly articles, collaboration between researchers, journal citations and connections between scientific terminologies (Oladinrin et al., 2023). Utilizing this software to transform vast amounts of academic literature into visually appealing knowledge landscapes is invaluable. Its capabilities in facilitating the organization, aggregation, and presentation of research data render it a vital component of this research (Wang et al., 2023).

An increasing number of scholarly investigations have scrutinized the ramifications of DFI on diverse outcomes, including but not limited to manufacturing servitization, resilience to disruptions, and economic growth. Ozturk and Ullah, discovered that while DFI positively affects economic development in One Belt, One Road (OBOR) economies, it negatively affects environmental sustainability by increasing CO2 emissions (Ozturk & Ullah, 2022). Chen and Zhang found that digital finance promotes manufacturing servitization in China by assisting manufacturers in developing new services and entering new markets (Chen & Zhang, 2021). Mukalayi and Inglesi-Lotz, established that DFI is positively correlated with both energy consumption and CO2 emissions in Sub-Saharan African countries (Mukalayi & Inglesi-Lotz, 2023). Lu discovered that DFI has a positive influence on the ESG disclosure of Chinese companies (Lu et al., 2022). Finally, Ayadi and Shaban, found that DFI was instrumental in facilitating access to vital financial services for individuals amid the COVID-19 pandemic (Ayadi & Shaban, 2020).

Despite the growing body of scholarly literature on DFI, bibliometric analysis in this field remains scant. A notable exception is the research by Gallego-Losada, Montero-Navarro, who used the Scopus database to perform a

bibliometric analysis of DFI studies (Gallego-Losada et al., 2023). They found that DFI research spans a wide range of disciplines, including economics, finance, information systems, business, and development studies. This study utilizes VOSviewer software to conduct a bibliometric analysis of the DFI field to fill the gaps in the literature. The findings of the bibliometric analysis are essential for policymakers, researchers, and practitioners to determine the novelty and quantity of data. In addition to providing a comprehensive overview of the current body of literature, the research aims to make a scholarly contribution to the ongoing discourse on this topic.

2. MATERIALS AND METHODS

In this study, we used bibliometric and descriptive quantitative methodologies. We included journals indexed by Google Scholar due to their easy accessibility. We also conducted a comprehensive literature review using Publish or Perish software, chosen for its bibliometric data extraction capabilities (Heumüller et al., 2020). We formatted and stored the data extracted via Publish or Perish for VOSviewer software analysis. We specifically used Publish or Perish 8 and VOSviewer 1.6.17 throughout the research. The initial dataset encompassed articles related to digital financial inclusion. Using the keyword "digital financial inclusion" and considering title, keywords, and abstract criteria within Publish or Perish, we retrieved a total of 980 articles. However, through careful data filtering, we refined the collection to 125 relevant journals. These publications, published between 2018 and 2023, were stored in *ris format. Subsequently, we used VOSviewer software to generate and analyse bibliometric maps from the extracted dataset. VOSviewer software facilitated the creation of three types of mapping data: network, overlay, and density visualizations. Furthermore, we refined the terms included in the VOSviewer mapping visualization to make our analysis clearer and more relevant.

3. RESULTS AND DISCUSSION

3.1. Research development in the field of digital financial inclusion

DFI has emerged as a prominent area of research in recent years. In 2018, there were only 7 publications on DFI, but this number increased to 18 in 2019, suggesting a growing interest in the topic. The number of publications remained relatively stable in 2020 (17) and 2021 (17), but there was a substantial surge in research interest in 2022 (37 publications). Although there was a slight decrease to 29 publications in 2023, it remained notably high, indicating that DFI continues to be an actively researched field reaching a total of 125 published articles.

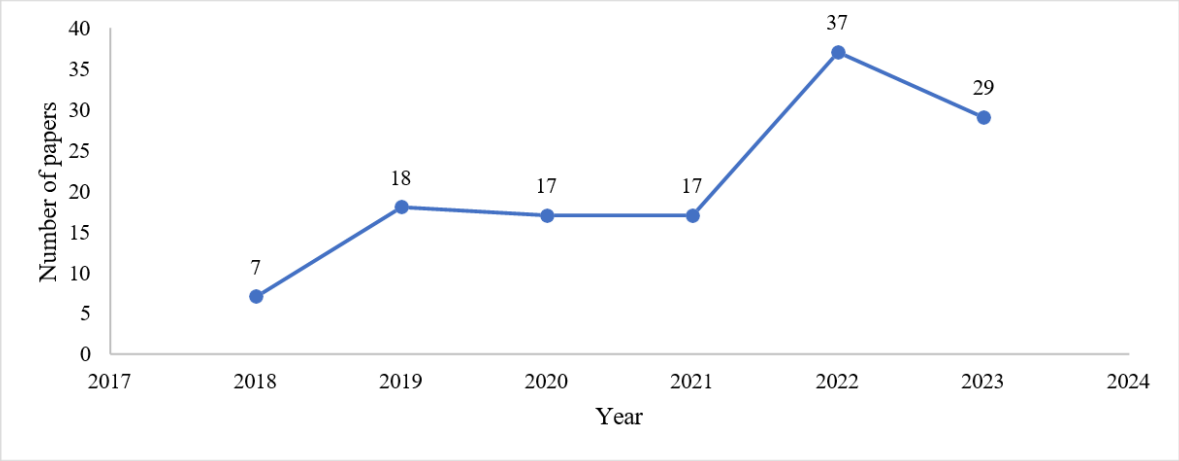

Fig. 1. Levels of development of research on digital financial inclusion

Table 1 presents data from 20 highly cited articles on digital financial inclusion (DFI), providing insights into the citation patterns and impact within this field. The most cited article, by Ozturk & Ullah (2022), has 146 citations, highlighting its significant influence. Chen and Zhang study has received 99 citations, further underscoring its significance (Chen & Zhang, 2021). Other articles have received varying degrees of citations, ranging from 54 to single-digit citations. This analysis contributes to a deeper understanding of the field's dynamics and influential studies.

Table 1. Article Data in the Field of Digital Financial Inclusion

No	Authors	Title	Year	Cites	Refs
1	Ozturk & Ullah	Does digital financial inclusion matter for economic growth and environmental sustainability in OBRI economies? An empirical analysis	2022	146	(Ozturk & Ullah, 2022)
2	Chen & Zhang	Does digital finance promote manufacturing servitization: Micro evidence from China	2021	99	(Chen & Zhang, 2021)
3	Yi & Zhou	Does digital financial inclusion significantly influence household consumption? Evidence from household survey data in China	2018	54	(Yi & Zhou, 2018)
4	Liu & Zhang	Digital financial inclusion, multidimensional education, and farmers' entrepreneurial behaviour	2021	22	(Liu & Zhang, 2021)
5	Ayadi & Shaban	Digital financial inclusion: a pillar of resilience amidst Covid-19	2020	17	(Ayadi & Shaban, 2020)
6	Ma & Li	Does digital financial inclusion affect agricultural eco- efficiency? A case study on China	2021	17	(Ma & Li, 2021)
7	Mukalayi et al.	Digital financial inclusion and energy and environment: global positioning of sub-	2023	12	(Mukalayi & Inglesi-

		Saharan African countries			Lotz, 2023)
8	Du et al.	Does digital financial inclusion promote the optimization of industrial structure	2020	10	(Du et al., 2020)
9	Lu et al.	Does digital financial inclusion matter for firms' ESG disclosure? Evidence from China	2022	5	(Lu et al., 2022)
10	Li et al.	Digital financial inclusion and urban-rural income gap: a literature-based analysis	2020	4	(Li et al., 2020)
11	Zhang & Bai	Does digital financial inclusion reduce the urban-rural income Gap? Panel threshold regression analysis based on China's provincial data	2018	4	(Zhang & Bai, 2018)
12	Mulungula & Nimubona	Digital financial inclusion and trade openness in Africa	2022	4	(Mulungula & Nimubona, 2022)
13	Tay et al.	Digital financial inclusion: A gateway to sustainable development	2022	4	(Tay et al., 2022)
14	Mondal	Digital financial inclusion and inclusive development of India	2020	3	(Mondal, 2020)
15	Raji	Digital financial inclusion in Africa: an analytical assessment of Kenya & Nigeria	2020	3	(Raji, 2020)
16	Ren & Li	Does digital financial inclusion promote inclusive rural growth: A study based on the survey data of 2114 rural residents in Beijing-Tianjin-Hebei	2019	3	(Ren & Li, 2019)
17	Atellu & Muriu	Does financial inclusion enhance financial stability? Evidence from a Developing Economy	2022	3	(Atellu & Muriu, 2022)
18	Dongjiao & Pengtao	Digital financial inclusion & home business insurance purchase	2021	2	(Dongjiao & Pengtao, 2021)
19	Lai et al.	Digital financial inclusion and consumption smoothing in China.	2020	2	(Lai et al., 2020)
20	Moonsamy	Digital financial inclusion through consumer adoption of digital payments in South Africa	2018	1	(Moonsamy, 2018)

3.2. Visualization of digital financial inclusion topic area using VOSviewer

The VOSviewer network requires a minimum of 2 relationships between 2 terms, meaning they must be mentioned in at least two different sources for them to be linked together (Van Eck & Waltman, 2010). Nonetheless, in our study, the minimum number of relationships in the VOSviewer between terms 3. Thus, the results showed 55 items with a total of 6 clusters. Studies linked to digital financial inclusion based on visualization mapping analysis are divided into 6 clusters, namely:

Cluster 1 has 12 items, the items are application, artificial intelligence, blockchain, blockchain technology, central bank, central bank digital

currency, challenge, digital currency, digital transaction, financial system, opportunity, and technology (see Figure 2).

Cluster 2 has 12 items and these items are digital, digital platform, digital technology, education, framework, future, government, implementation, industry, influence, need, and women (see Figure 3).

Cluster 3 comprises 11 items and the 11 items are digital divide, digital economy, digital economy, digital inclusion, digital literacy, digitalization, inclusive growth, internet, mobile money, mobile phone, process, and society (see Figure 4).

Cluster 4 has 9 items, the 9 items are addition, article, consumer, context, digital innovation, digital transformation, mobile banking, SMEs, and theory (see Figure 5).

Cluster 5 has 8 items and the 8 items are digital finance, economic growth, evidence, financial stability, income equality, index, information, and poverty (see Figure 6).

Cluster 6 has 3 items and the 3 items are COVID-19, digital payment, and pandemic (see Figure 7).

Regarding the colour of the display, Cluster 1 is displayed in red, Cluster 2 is displayed in green, Cluster 3 is displayed in dark blue, Cluster 4 is displayed in yellow, Cluster 5 is displayed in purple, and Cluster 6 is displayed in light blue.

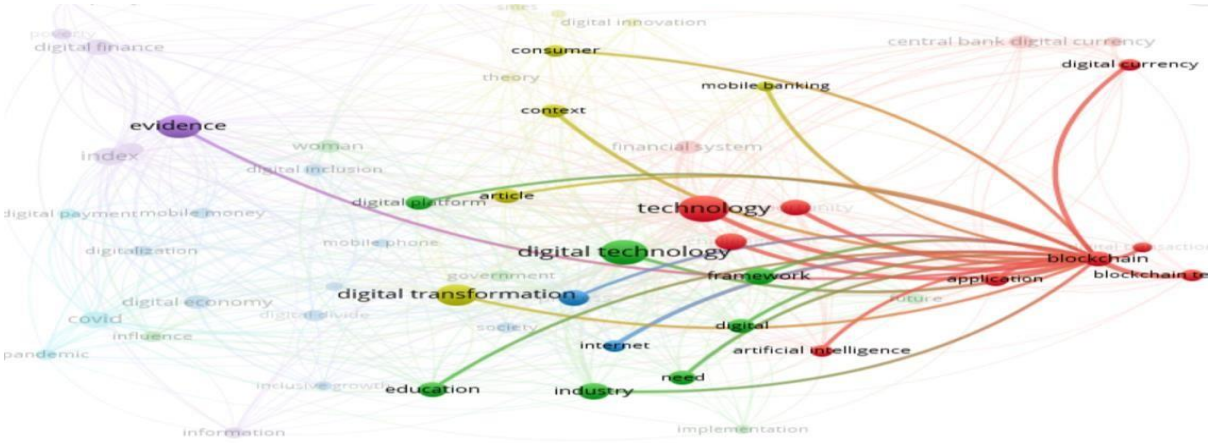

Fig. 2. Cluster 1 Network visualization on digital financial inclusion

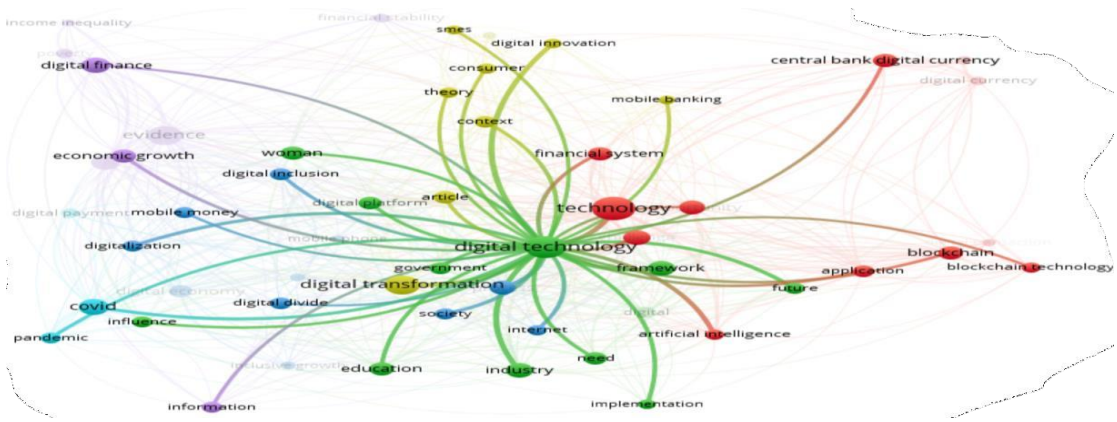

Fig. 3. Cluster 2 Network visualization on digital financial inclusion

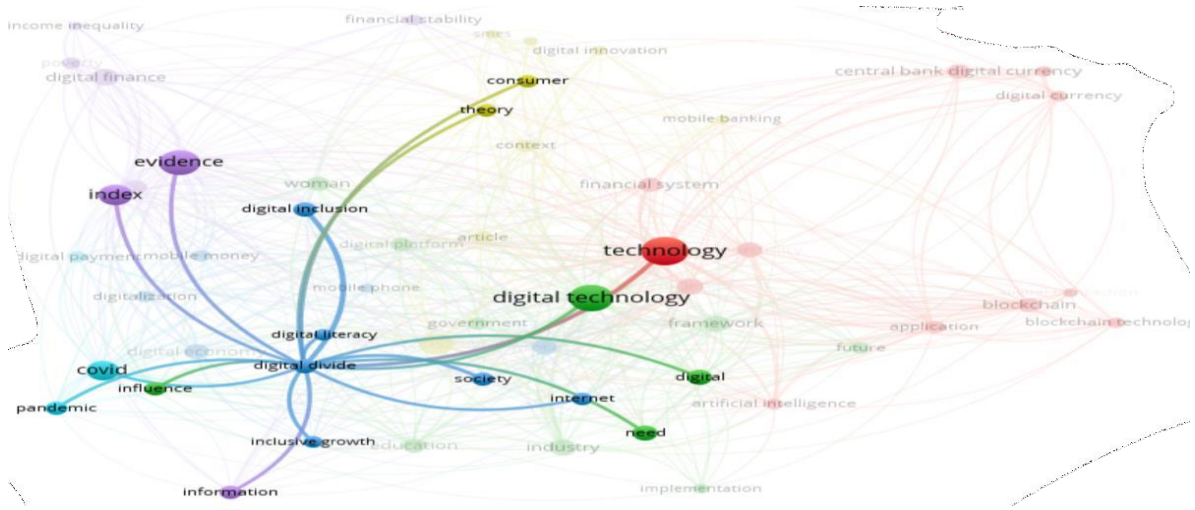

Fig. 4. Cluster 3 Network visualization on digital financial inclusion

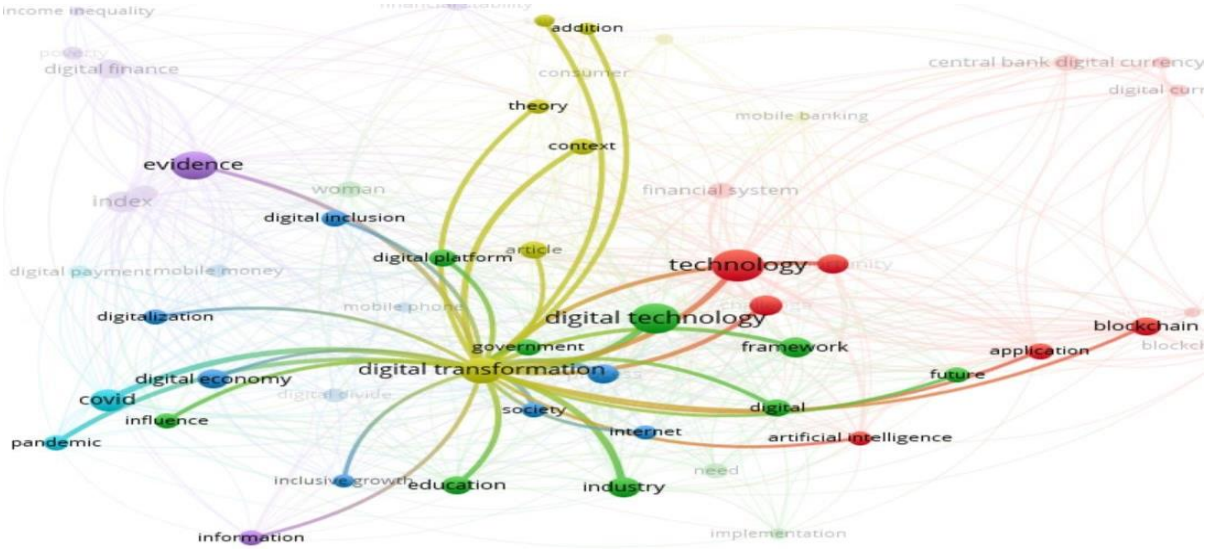

Fig. 5. Cluster 4 Network visualization on digital financial inclusion

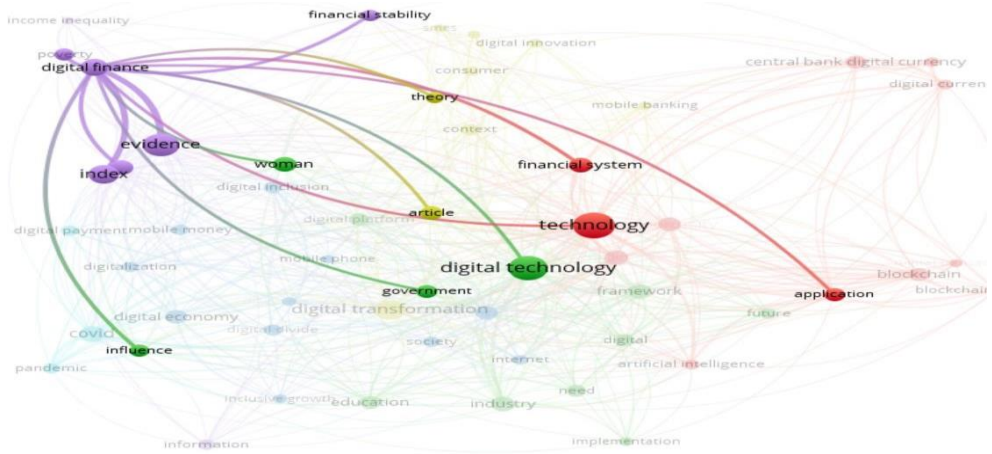

Fig. 6. Cluster 5 Network visualization on digital financial inclusion

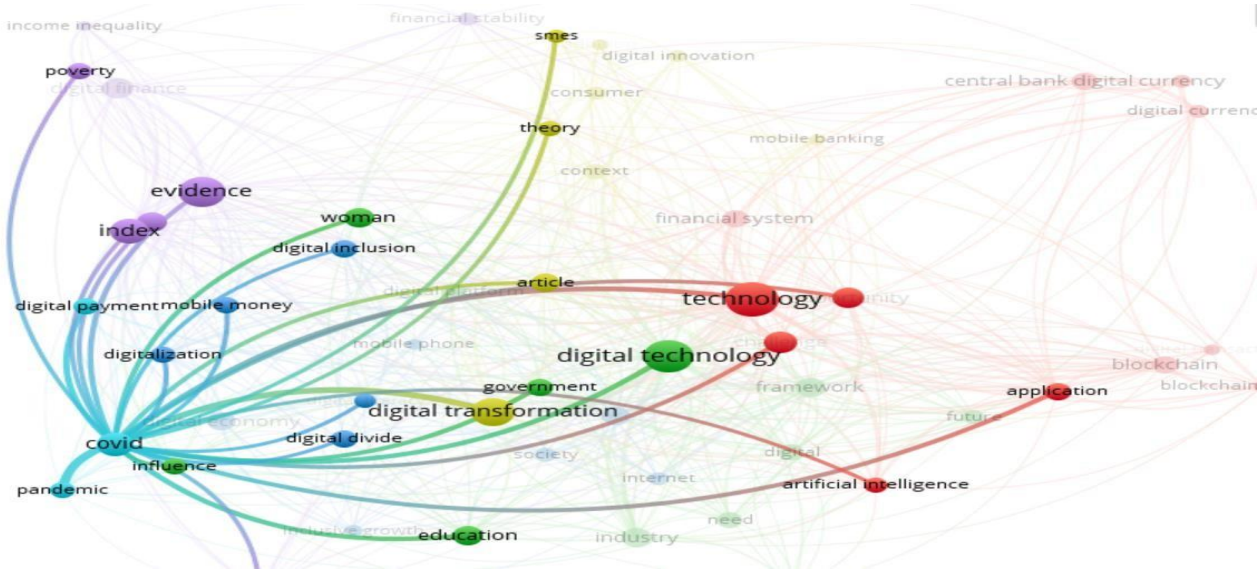

Fig. 7. Cluster 6 Network visualization on digital financial inclusion

3.3. Network visualization digital financial inclusion topic area using VOSviewer

VOSviewer provides three types of mappings for each term, including Network Visualization. Network Visualization depicts the relationships between terms on a map, using lines to connect related terms. Figure 8 shows the Network Visualization of the term "Digital Financial Inclusion" (DFI) in VOSviewer. The visualization shows clusters of related terms, with DFI in cluster 3. Cluster 3 has a total strength of 27 and an occurrence of 21. DFI is connected to cluster 2 (Digital Technology), cluster 1 (Digital Transformation), and cluster 6 (COVID-19).

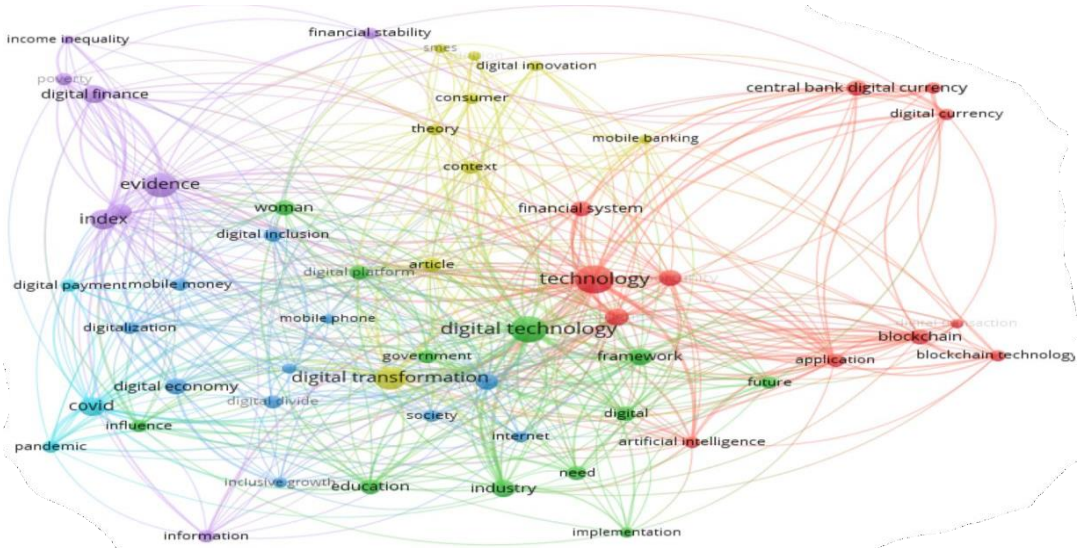

Fig. 8. Network visualization on digital financial inclusion

3.4. Overley visualization digital financial inclusion topic area using VOSviewer

Digital financial inclusion (DFI) is a growing research term in the field of digital financial services, with a growing prominence in recent years. The term's colour transition to yellow indicates its recent addition to the lexicon of digital financial services, indicating its recent emergence as a discrete field of study. The association of DFI with other terms like digital technology, digital transformation, and COVID-19 highlights its multifaceted nature and strong connection to significant developments and trends in the digital age. DFI is a social and economic phenomenon, not just a technological innovation. Its prominence as a research keyword, closely related to emissions and food, suggests its potential to address urgent global issues, such as poverty reduction and sustainable development.

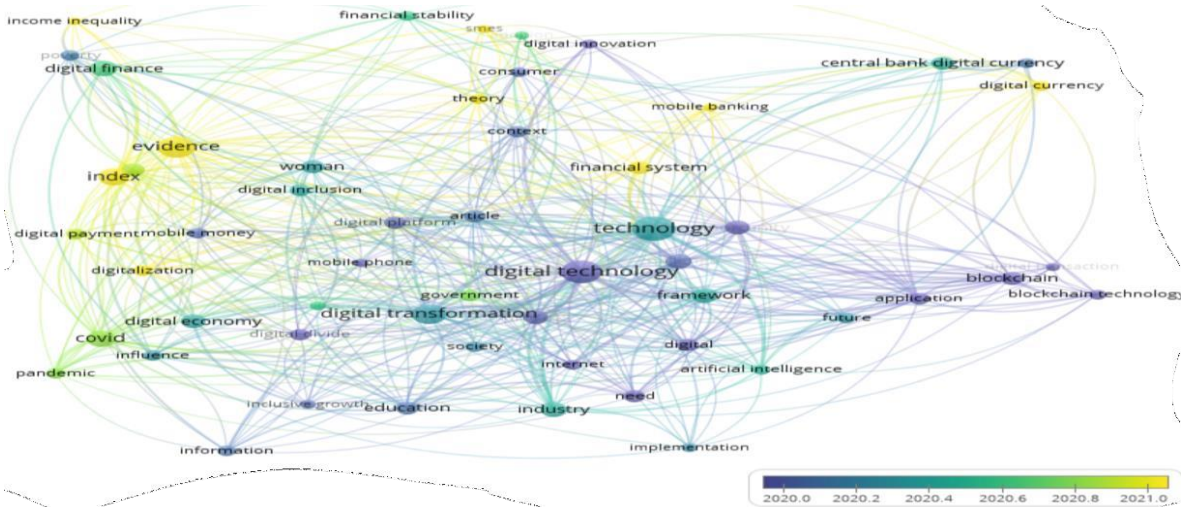

Fig. 9. Overley visualization on digital financial inclusion topic area using VOSviewer

The concept is also linked to other significant developments and trends in the digital age, indicating its social and economic importance. DFI's potential to reduce poverty and inequality while promoting sustainable development is supported by its association with other significant developments in the digital age (Ouyang, 2022).

3.5. Density Visualization of Digital Financial Inclusion

The density visualisation of digital financial inclusion highlights the most frequently discussed topics, such as sustainable development, mobile money, financial technology, and financial inclusion as shown in Figure 10. The yellow colour in the density map indicates their high frequency in prior research, and larger diameters indicate their greater significance. Emerging research areas in digital financial inclusion include "financial literacy," "women's empowerment," and "financial inclusion for the poor." The term "financial technology" has gained significant traction in recent years, indicating the potential of fintech to expand the reach of financial services.

The concept of mobile money is also widely used, indicating the potential of mobile money to facilitate greater accessibility to financial services in developing nations (Bawuah, 2023; Azergun, 2021).

"Sustainable development" is an emerging field of study within the realm of digital financial inclusion, indicating the potential of digital financial inclusion to advance sustainable development objectives. The concepts of "financial literacy," "women's empowerment," and "financial inclusion for the poor" are also burgeoning research areas, indicating the role of digital financial inclusion in enhancing the financial well- being of marginalized groups. The density visualisation illustrates the progressive development of digital financial inclusion research, with the term "financial technology" gaining significant traction, indicating the increasing focus on the potential of fintech to improve the financial sector and the reach of services (Oyewola & Dada, 2022).

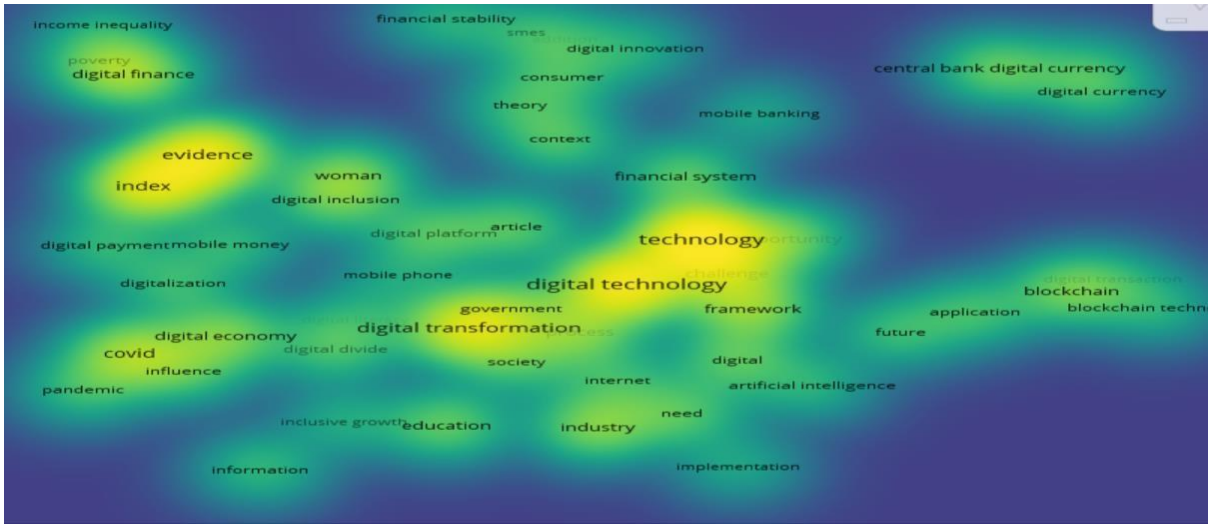

Fig. 10. Density Visualization on digital financial inclusion

4. CONCLUSION

The objective of this research is to examine the bibliometric sources pertaining to digital financial inclusion (DFI). A subject area comprising keywords, abstracts, and titles yielded 125 pertinent articles when the keyword "digital financial inclusion" was applied. We generated mapping data, including network, overlay, and density visualisations, using the VOSviewer software. Digital financial services research about "digital financial inclusion" was the most studied topic between 2018 and 2023, according to our findings. We identified key themes in each of the previous studies using bibliometrics for this study, which is useful for determining the novelty of future research.

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