



Mapping the Rural–Urban Digital Divide in Banking: A Bibliometric Analysis of Global Research Trends, Knowledge Structure, and Future Research Directions

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Abstract: The rural–urban digital divide continues to hinder equitable access to digital technologies, digital banking, and financial inclusion, making it an important area of academic and policy research. This study presents a bibliometric analysis of global research on the rural–urban digital divide using 549 publications retrieved from the Web of Science Core Collection for the period 2015–2025. Bibliometric techniques were applied using Bibliometrix (Biblioshiny) to examine publication trends, citation patterns, influential authors, journals, countries, and research themes. The findings reveal a steady increase in research output, particularly after 2020, highlighting the growing importance of digital inclusion in achieving sustainable development. China and the United States emerged as the leading contributors, while Telecommunications Policy was identified as the most productive journal. Keyword and thematic analyses indicate that research has evolved from focusing on digital infrastructure and internet access to digital literacy, technology adoption, and digital inclusion. Despite this growth, gaps remain in research from developing countries and in understanding the long-term impact of digital technologies on financial inclusion. The study provides a comprehensive overview of the field and offers valuable directions for future research and policymaking.

Index Terms - Digital divide; Digital inclusion; Financial inclusion; Digital banking; FinTech; Bibliometric analysis; Banking

I. INTRODUCTION

The rapid expansion of digital technologies has transformed the way individuals access information, financial services, education, healthcare, and public services. Digitalization has created new opportunities for economic development and social inclusion by reducing geographical barriers and improving access to essential services. However, these benefits have not been distributed equally. Significant disparities persist between rural and urban populations in terms of internet access, digital infrastructure, affordability, digital literacy, and the effective use of digital technologies. This disparity, commonly referred to as the rural–urban digital divide, has become one of the most pressing challenges for achieving inclusive and sustainable development (van Dijk, 2020; Scheerder et al., 2017).

The COVID-19 pandemic further exposed the consequences of digital inequalities, as education, banking, healthcare, and government services increasingly shifted to digital platforms. Individuals living in rural areas often faced limited connectivity, inadequate digital skills, and poor technological infrastructure, restricting their participation in digital economies and widening existing socio-economic inequalities (Robinson et al., 2020). In particular, digital financial services such as mobile banking, internet banking, and financial technology (FinTech) have become essential tools for promoting financial inclusion.

Nevertheless, unequal digital access continues to prevent many rural communities from fully benefiting from these innovations (Ozili, 2020).

Existing research has extensively examined the determinants and consequences of the digital divide from technological, economic, and social perspectives. Earlier studies primarily focused on physical access to information and communication technologies (van Dijk, 2020). More recent studies have broadened this perspective by emphasizing digital literacy, digital skills, technology adoption, and the meaningful use of digital technologies in reducing inequalities (Scheerder et al., 2017). Researchers have also investigated the relationship between digital inclusion and financial inclusion, demonstrating that digital technologies can improve access to banking services, reduce transaction costs, and promote economic participation, particularly in underserved regions (Ozili, 2020; Aker & Mbiti, 2010). Furthermore, studies have highlighted the importance of government policies, broadband infrastructure, institutional support, and socio-economic factors in narrowing the rural–urban digital divide (Whitacre et al., 2014; Alam & Imran, 2015).

Despite the growing body of literature, the research remains fragmented across multiple disciplines, including information systems, telecommunications, economics, rural development, and public policy. Most existing studies focus on specific countries, technologies, or policy interventions, providing limited understanding of the overall evolution of the field. Although several narrative and systematic literature reviews have summarized selected aspects of digital inclusion and digital inequality, there is limited evidence that comprehensively maps the intellectual structure, publication trends, influential contributors, collaboration patterns, and emerging research themes related to the rural–urban digital divide in the context of digital banking, financial inclusion, and FinTech. A bibliometric approach is particularly valuable because it enables a systematic and quantitative evaluation of the development of a research field, identifies influential publications and contributors, and uncovers emerging knowledge structures and future research directions (Donthu et al., 2021).

Addressing this gap, the present study conducts a comprehensive bibliometric analysis of publications indexed in the Web of Science Core Collection between 2015 and 2025. Using the Bibliometrix package in R (Biblioshiny), the study examines the evolution of scientific production, citation patterns, influential authors and journals, geographical distribution of publications, and the conceptual structure of the field through keyword co-occurrence, thematic mapping, and trend topic analyses. By synthesizing the existing knowledge base, this study provides a comprehensive overview of the intellectual development of research on the rural–urban digital divide and identifies promising directions for future investigation. Accordingly, the study aims to achieve the following objectives:

1. To analyze the trends in publication output and citation activity over time.
2. To recognize the most influential authors, highly cited articles, and journals in the field.
3. To assess the geographical distribution of publications in the field.
4. To identify the main research themes and emerging topics in the field.
5. To determine research gaps and potential avenues for future investigation.

II. MATERIALS AND METHODS

This study employed a bibliometric research design to systematically examine the existing literature on the rural–urban digital divide in relation to digital banking, financial inclusion, and financial technology. Bibliometric analysis was selected because it enables a quantitative assessment of the evolution of a research field, identifies influential contributors and publications, and reveals emerging research themes and collaboration patterns.

The Web of Science Core Collection was used as the sole source of bibliographic data owing to its comprehensive coverage of high-quality, peer-reviewed scholarly publications. To retrieve relevant studies, a topic search was conducted using the following search query:

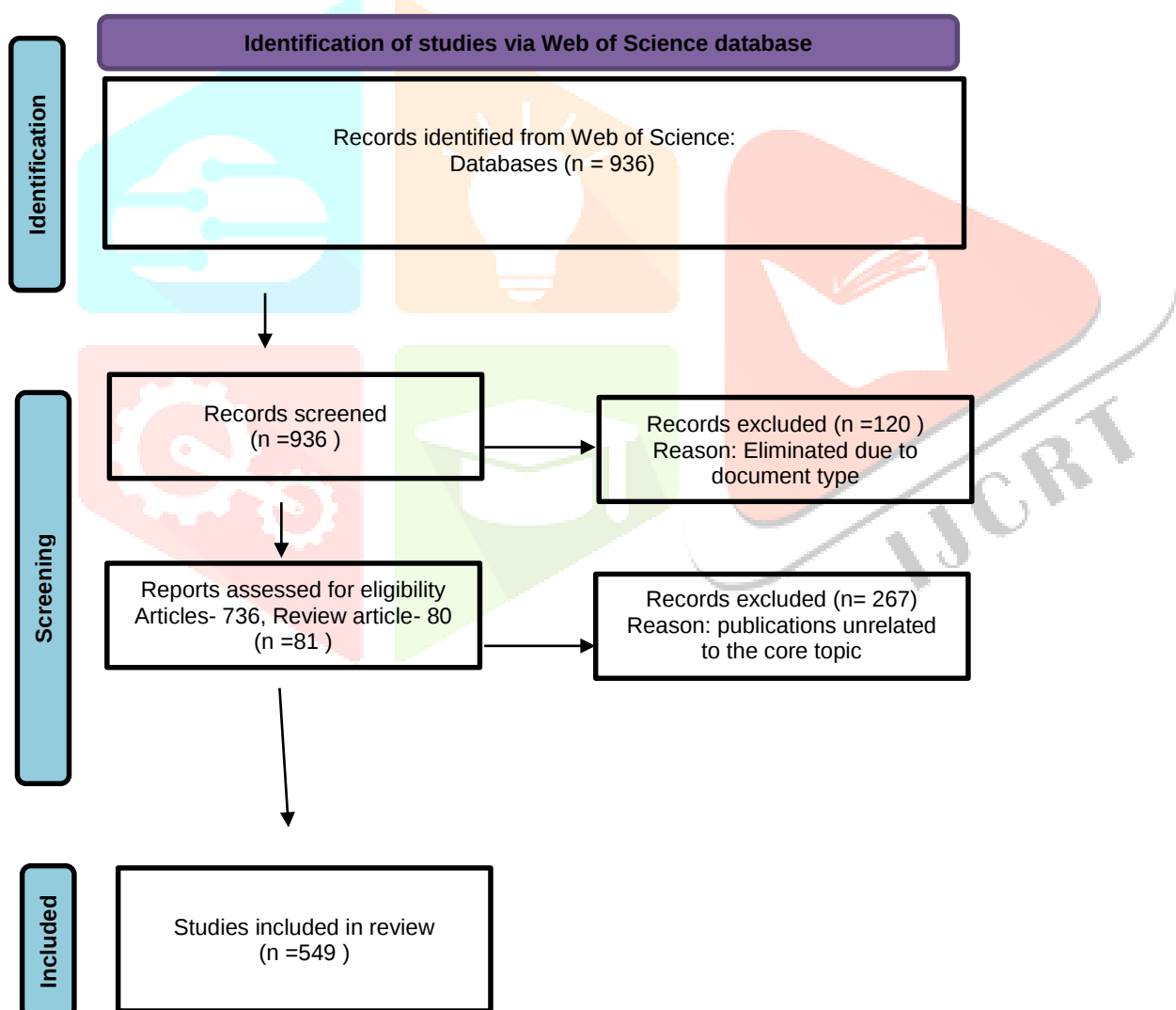
*TS=((("digital divide" OR "digital inequality" OR "digital inclusion") AND (rural OR urban OR "financial inclusion" OR bank OR fintech OR "digital banking" OR "mobile banking")))**

To ensure the relevance and quality of the dataset, several inclusion criteria were applied. Only publications published between 2015 and 2025 were considered, as this period reflects the rapid

expansion of digital financial services and increasing scholarly attention to digital inclusion. The search was further restricted to English-language publications to maintain consistency in data analysis. Additionally, only studies classified under the Economics, Business, Management, Business Finance, and Social Sciences research areas were included, as these disciplines closely align with the objectives of the study.

The initial search retrieved 936 records from the Web of Science database. Document types other than journal articles and review articles were excluded, resulting in the removal of 120 records. The remaining 816 publications (736 articles and 80 review articles) were subjected to title and abstract screening. During this stage, 267 records that were unrelated to the core research theme were excluded. Consequently, 549 publications were retained for the final bibliometric analysis. The study selection process followed the PRISMA framework, ensuring a transparent and systematic screening procedure. The final dataset was exported in plain text format with complete bibliographic information, including authors, titles, abstracts, keywords, affiliations, cited references, and citation details. The data were analysed using the Bibliometrix package through Biblioshiny in RStudio.

Figure 1: The PRISMA flow diagram is used to identify, screen, and include papers in the bibliometric analysis



III. FINDINGS

3.1 Key Information Regarding the Investigation

The bibliometric investigation was conducted using a dataset of 549 publications retrieved from the Web of Science Core Collection, covering the period from 2015 to 2025. These publications were drawn from 199 scholarly sources, reflecting the multidisciplinary nature of research on the rural–urban digital divide, digital banking, and financial inclusion. The selected publications had an average document age of 3.87 years, indicating that the field is relatively recent and continues to evolve. On average, each publication received 25.78 citations, demonstrating the growing academic interest and scholarly influence of this research domain.

The dataset contained 28,011 cited references, highlighting the extensive knowledge base underpinning the field. A total of 1,510 authors contributed to the publications, of whom 75 authored single-authored papers, while the remaining publications reflected collaborative research efforts. The average of 3.05 co-authors per document and an international co-authorship rate of 26.78% indicate a moderate level of global research collaboration.

With respect to research themes, the dataset comprised 1,739 author keywords and 912 Keywords Plus, illustrating the breadth and diversity of topics explored within the literature. Overall, the dataset provides a comprehensive representation of contemporary research on the intersection of digital inclusion, rural–urban disparities, digital banking, and financial inclusion, forming a robust basis for the subsequent bibliometric analyses.

3.2 Scientific Output Over the Years

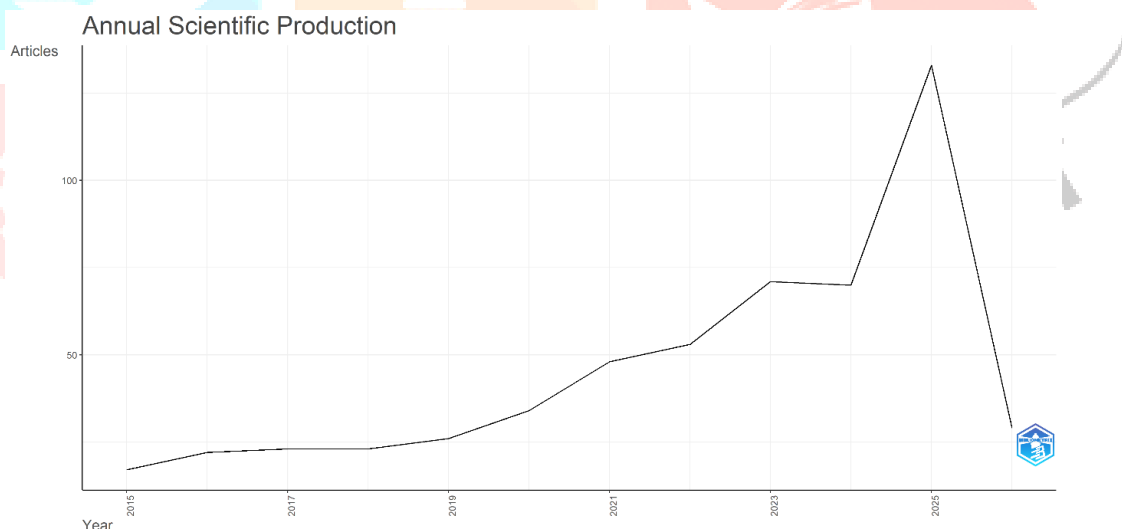


Figure 2: Annual Scientific Production

Figure 2 shows the annual scientific output in the areas of the rural-urban digital divide, digital banking, and financial inclusion from 2015 to 2025. As shown, there is a consistent increasing trend in the amount of research produced during the period of study due to the growing attention that scholars pay to the issue. There has been an increase from 17 publications in 2015 to 53 publications in 2022, and then a more noticeable increase in 2023 (71 publications) and 2024 (70 publications). The maximum amount of research production was achieved in 2025 (133 publications). Thus, one can assume that the problems associated with digital inclusion, digital banking, and financial inclusion have become a matter of growing attention, especially considering the development of new technologies.

3.3 Average Citations Per Year

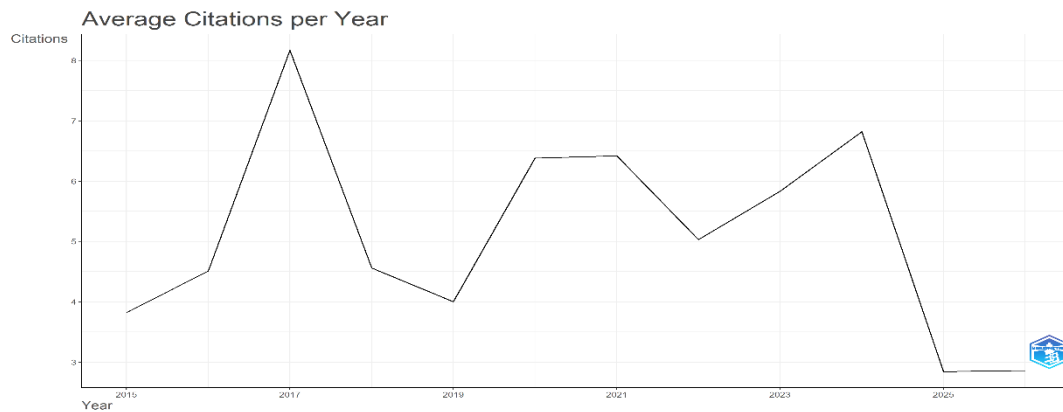


Figure 3: Average Citation Per Year

The citation analysis indicates that publications from 2017 achieved the highest scholarly impact, recording an average of 81.74 citations per article and 8.17 citations per article per year. Articles published between 2015 and 2021 generally attracted higher citation counts, reflecting their longer presence in the literature and greater visibility among researchers.

Although the number of publications increased substantially from 2022 onward, the average citations per article declined, with 2025 and 2026 showing the lowest citation values. This trend is expected because recently published studies have had less time to accumulate citations. Overall, the findings suggest that while research output in the field has grown rapidly in recent years, earlier publications continue to exert a stronger academic influence due to their longer citation window.

3.4 Top Influential Researchers

Table 1. Most Relevant Authors in the Research Field

Author	Articles
Whitacre, Brian	8
Correa, Teresa	7
Alam, Khorshed	6
Chen, Wenhong	6
Li, Xiaoqian	6
McMahon, Rob	6
Pavez, Isabel	6
Helderop, Edward	5

Table 1 shows the most influential researchers in the field of rural-urban digital divide, digital banking, and financial inclusion. Brian Whitacre was the most prolific author with eight papers, followed by Teresa Correa who has seven publications in the same category. The authors who have produced six papers each include Khorshed Alam, Wenhong Chen, Xiaoqian Li, Rob McMahon, and Isabel Pavez, whereas Edward Helderop authored five papers. The narrow gap between the publication counts of the top researchers indicates that this research field has been performed by multiple researchers as opposed to having one dominant researcher in the field. This demonstrates the collaborative nature of the field and has contributions from various scholars specializing in digital inclusion, ICTs, financial inclusion, and rural development.

3.5 Prominent Scientific Journal

Table 2. Most Relevant Sources

Source	Articles
Telecommunications Policy	51
Technology in Society	21
Telematics and Informatics	21
Cities	19
Information, Communication & Society	17
SAGE Open	14
Applied Economics	13
Information Development	13
Journal of Rural Studies	13
Journal of the Knowledge Economy	12

Table 2 shows the prominent publishing sources within the field of research. The Telecommunications Policy was found to be the most dominant source of publications with 51 publications, much higher than the other journals. The Technology in Society and Telematics and Informatics came second with 21 publications, respectively, while Cities published 19 publications. This reveals that the dominance of journals on telecommunications, digital technology, society, and rural development shows the interdisciplinary approach of the research on the rural-urban digital divide and digital banking.

3.6 Global Research Contributions by Nations

Table 3: Countries' Scientific Production

Country	Number of Publications
China	415
United States	277
United Kingdom	77
Australia	63
Spain	45
India	34

From the analysis of literature based on country, it is found that the major contributor in terms of research is China, which has 415 research articles, and then comes the United States with 277 research publications. Countries such as the United Kingdom and Australia also show considerable research, while Spain and India have contributed to the field moderately. It is evident from the results that there is considerable research output coming from selected developed and developing countries, reflecting their capacity for research in the subject.

3.7 Most Globally Cited Documents

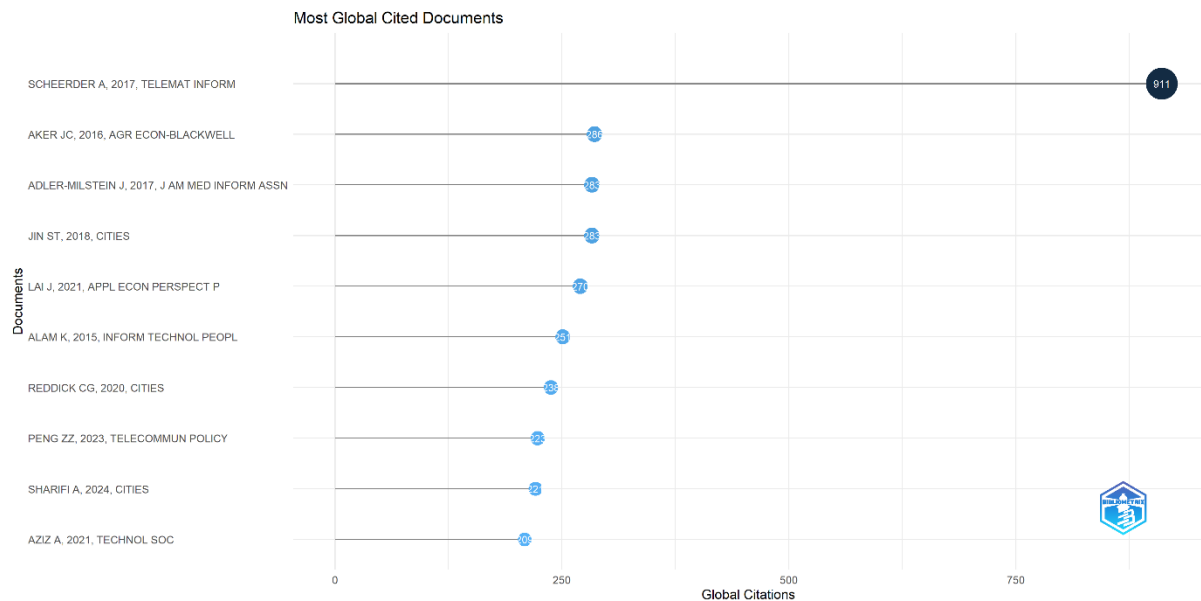


Figure 4: Most globally cited documents

Global citation analysis emphasizes the works that have been most influential in terms of developing this research area. Scheerder et al. (2017) is the most cited work, having 911 global citations, thus being an integral part of the literature in this field. It is followed by Aker (2016) with 286 citations; in addition, works by Adler-Milstein (2017) and Jin (2018) are cited 283 times.

Among other significant works are those by Lai (2021) cited 270 times, Alam (2015) – 251, and Reddick (2020) - 238. Among more recent works are those by Peng (2023), Sharifi (2024), and Aziz (2021) with comparatively low citation rates. The latter can be explained by the fact that the works have been published recently and have not yet acquired popularity. From the findings above, it is evident that a few highly cited works have had a decisive influence on the development of the field.

3.8 Most Relevant Keywords

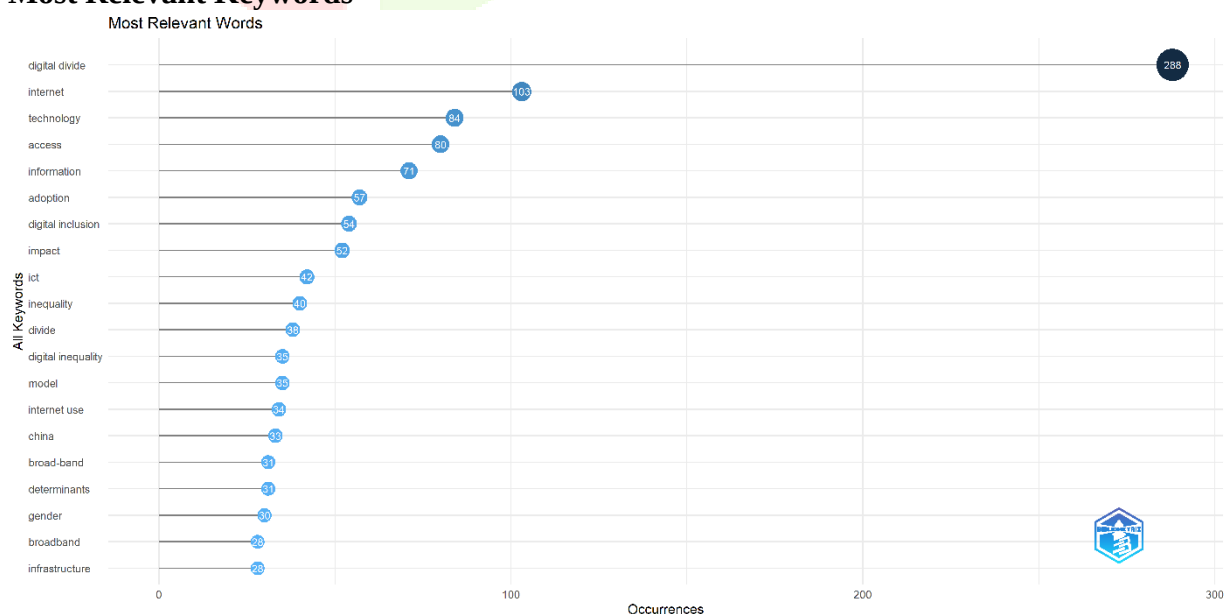


Figure 5: Most relevant keywords

The study of the top keywords provides the major research areas that dominate the domain. The keyword digital divide has the highest frequency, namely 288 occurrences, which demonstrates the key role of this concept in the literature. Other commonly found keywords are internet (103), technology (84), access (80), and information (71). It means that the research is mainly centered on connectivity, technological innovations, and access to information.

Moreover, adoption (57), digital inclusion (54), and impact (52) have become popular among the other keywords that prove the increase of the attention to the topic of technology adoption and digital inclusion and development. Also, such keywords as ICT, inequality, digital inequality, internet use, broadband, infrastructure, and gender prove that scholars have paid much attention to the problem of disparities in digital access and digital participation.

Thus, the analysis of the keywords proves that the scope of research in the domain has extended from the problem of digital access and infrastructure to the adoption and impact of digital technologies.

3.9 Key Word Co-occurrence Network

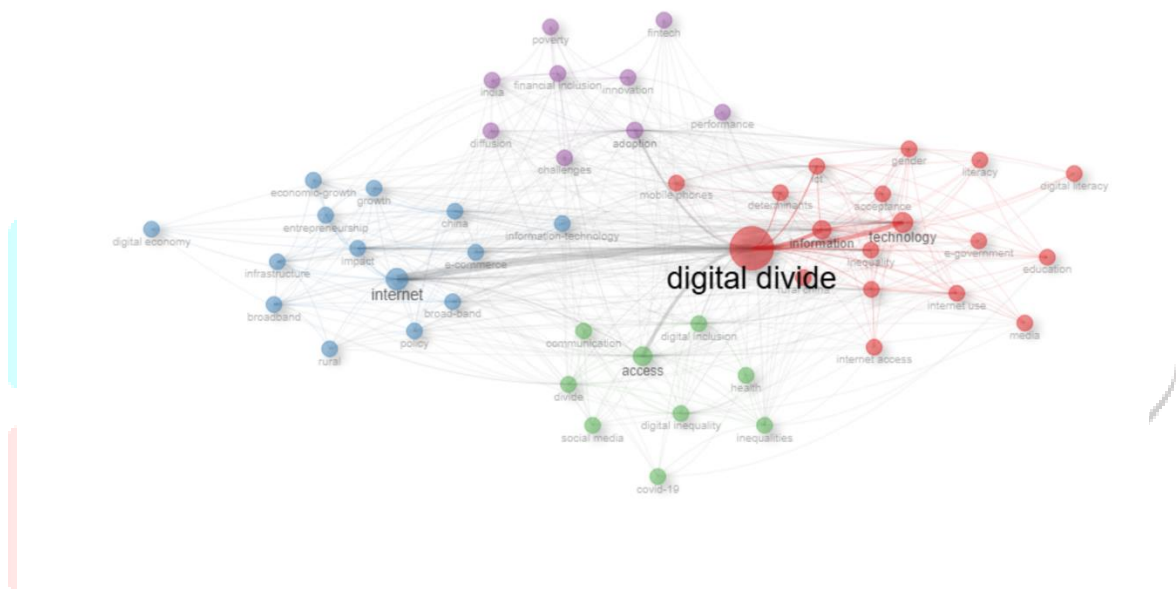


Figure 6: Co- word network analysis

The co-word network analysis highlights the key concepts that structure the research field and reveals how different topics are interconnected. Digital divide emerges as the most influential keyword, with the highest betweenness centrality (424.63) and PageRank (0.129), indicating that it acts as the central theme linking multiple research areas.

Other prominent keywords, including technology, information, ICT, inequality, and model, also play important roles in the knowledge structure, although their influence is considerably lower than that of the digital divide. The presence of keywords such as internet use, determinants, gender, and acceptance suggests that researchers have increasingly focused on understanding the factors influencing digital inclusion, technology adoption, and disparities in digital access.

Overall, the co-word network demonstrates that the literature is strongly centered on the concept of the digital divide, with technology, information access, and inequality forming its core supporting themes. This indicates that current research extends beyond access to digital technologies and increasingly examines the social, economic, and behavioural factors that shape digital inclusion.

3.10 Thematic Map

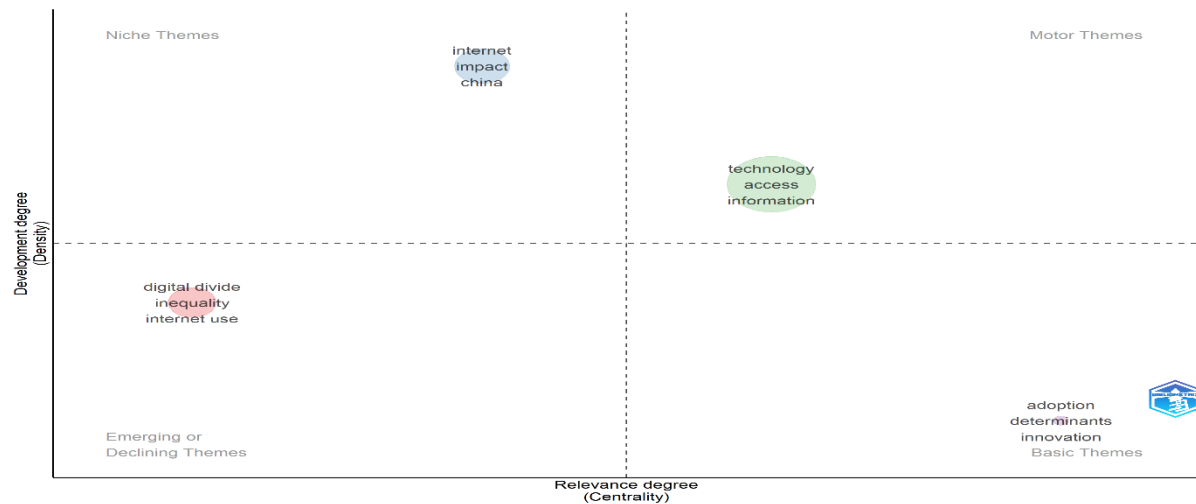


Figure 7: The thematic map

The thematic map provides an overview of the conceptual structure of the research field by classifying themes based on their relevance (centrality) and level of development (density).

The motor themes quadrant includes technology, access, and information, indicating that these are well-developed and central topics driving research in the field. Their strong connectivity suggests that they form the core of the existing literature and continue to attract significant scholarly attention.

The basic themes quadrant contains adoption, determinants, and innovation. These topics are fundamental to the field and are widely connected with other research areas, although they remain less developed than the motor themes. Their central position highlights their continued importance in shaping future research.

In the niche themes quadrant, internet, impact, and China appear as specialized but well-developed topics. These themes have a strong internal focus but are relatively isolated from the broader research landscape, indicating that they represent specific streams of investigation.

Finally, the emerging or declining themes quadrant includes digital divide, inequality, and internet use. These themes are less developed and have lower connectivity with the rest of the field. They may represent either newly emerging research directions with growing potential or areas that have received comparatively limited attention. Given the increasing global focus on digital inclusion, these topics offer promising opportunities for future research.

Overall, the thematic map suggests that while research has primarily focused on technology adoption, access, and information, issues related to the digital divide and inequality remain underexplored and present valuable avenues for further investigation.

3.11 Trend Topics

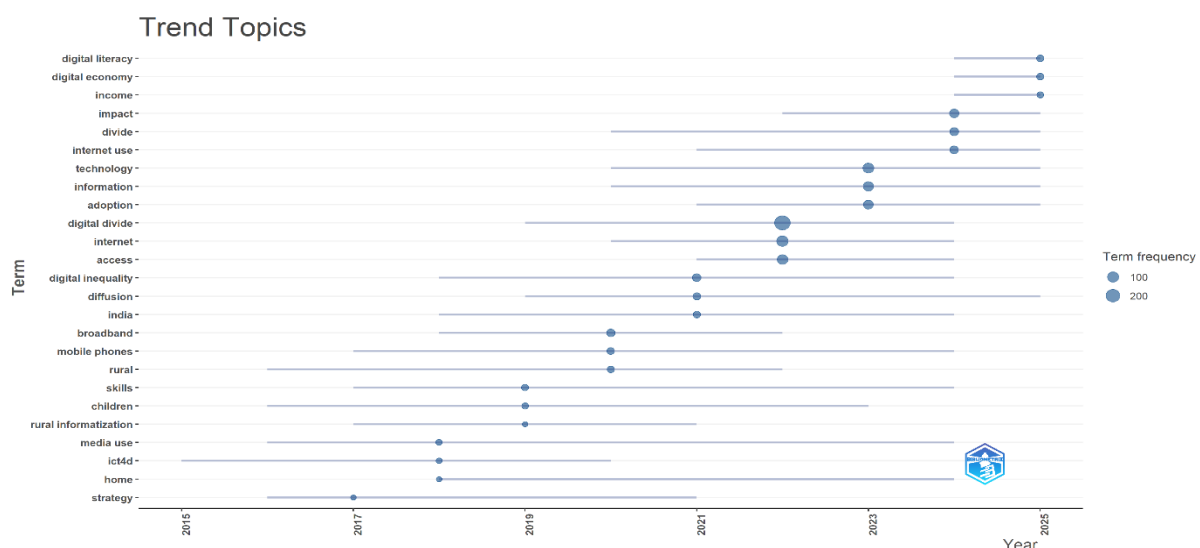


Figure 8: Trending topics

The topic trend analysis gives an insight into the changing research trends. From 2015 until 2018, the main areas explored were ICT4D, media use, home, strategy, rural informatization, children, and skills, emphasizing the need to build digital infrastructure and ensure digital access at the early stage of the field's development.

However, between 2019 and 2022, the field became more diverse due to rural development, mobile phones, broadband, India, diffusion, digital inequality, internet access, and especially the digital divide, which became one of the most frequent topics in the research at this stage. Thus, there was a growing interest in studying inequalities in terms of access to digital technologies and their consequences.

Finally, in 2023-2025, the researchers turned their attention to technology, information, adoption, internet use, impact, income, digital economy, and digital literacy. Digital economy and digital literacy, being recent research trends, show that now researchers are more concerned about developing economic potential based on digital technology and increasing digital skills.

Thus, the findings obtained show the clear trend in the field literature from enhancing digital access and infrastructure to technology adoption and, finally, the development of digital skills and involvement in the digital economy.

IV. DISCUSSION

The present bibliometric analysis provides a comprehensive overview of the evolution of research on the rural–urban digital divide in the context of digital banking, financial inclusion, and financial technology between 2015 and 2025. The findings demonstrate a substantial increase in scholarly output over the study period, reflecting the growing recognition of digital inclusion as a critical component of sustainable economic and social development. The marked rise in publications after 2020 is likely associated with the accelerated digital transformation triggered by the COVID-19 pandemic, which highlighted the importance of equitable access to digital technologies, online financial services, and digital infrastructure. This trend is consistent with previous studies, which argue that the pandemic intensified existing digital inequalities while simultaneously increasing research interest in digital inclusion and technology-enabled services (Robinson et al., 2020; Donthu et al., 2021).

The citation analysis indicates that earlier publications continue to exert the greatest scholarly influence, particularly those published between 2015 and 2021. These studies established much of the conceptual and theoretical foundation of the field, explaining why they have accumulated higher citation counts than more recent publications. Similar citation patterns have been observed in other bibliometric investigations, where influential early contributions continue to shape subsequent research despite the rapid growth in publication output (Donthu et al., 2021).

The analysis also reveals that research activity is concentrated among a relatively small number of countries, with China and the United States accounting for the largest share of scientific production. Their dominance reflects substantial investments in digital infrastructure, technological innovation, and research capacity. Although countries such as the United Kingdom, Australia, Spain, and India have made meaningful contributions, research from many developing regions remains comparatively limited. This geographical imbalance suggests the need for broader international collaboration and greater attention to the digital challenges faced by low- and middle-income economies. Previous studies have similarly emphasized that digital inequality varies considerably across national and regional contexts, requiring policies that are sensitive to local socio-economic conditions (van Dijk, 2020; Whitacre et al., 2014).

The findings further indicate that research on the rural–urban digital divide is inherently multidisciplinary. The prominence of journals such as *Telecommunications Policy*, *Technology in Society*, and *Telematics and Informatics* demonstrates that the field integrates perspectives from information systems, telecommunications, economics, rural development, and public policy. Likewise, the distribution of publications among several productive authors suggests that knowledge development has been driven through collaborative efforts rather than by a small group of dominant researchers.

Keyword and thematic analyses provide valuable insights into the intellectual structure of the field. The dominance of keywords such as digital divide, internet, technology, access, and information confirms that improving digital connectivity has remained the central focus of research. At the same time, the emergence of themes such as digital literacy, digital economy, technology adoption, and digital inclusion indicates that the literature has gradually shifted beyond physical access to examine the effective use of digital technologies and their broader socio-economic implications. This evolution closely aligns with the progression of digital divide theory, which suggests that contemporary research increasingly focuses

on digital skills, usage patterns, and the outcomes of technology adoption rather than simple access to technology (Scheerder et al., 2017; van Dijk, 2020).

The co-word network and thematic map reinforce this observation by demonstrating that the digital divide serves as the central concept linking technology, information, inequality, and digital adoption. While technology and access have become well-developed and influential themes, issues related to digital inequality, internet use, and equitable participation remain comparatively underdeveloped. This suggests that future research should increasingly examine how digital technologies contribute to financial inclusion, economic empowerment, and social equity, particularly among vulnerable and rural populations.

Overall, the findings indicate that research on the rural–urban digital divide has evolved from a primary concern with infrastructure and internet availability to a broader understanding of digital inclusion that incorporates digital literacy, technology adoption, and digital participation. Despite this progress, important knowledge gaps remain, particularly regarding developing countries, comparative cross-country studies, and the long-term impact of digital technologies on financial inclusion and sustainable rural development. Addressing these gaps will enhance theoretical understanding while providing evidence to support policymakers in designing more inclusive digital transformation strategies.

V. RESEARCH GAPS AND FUTURE RESEARCH DIRECTIONS

In conducting a bibliometric analysis of the relevant literature, several crucial gaps have been identified in current research. Even though there is a huge body of literature concerning the rural-urban digital divide issue over the past 10 years, there is still a lack of research conducted in certain countries – China, the US, UK, and Australia specifically. Lack of publications by researchers from developing countries indicates the necessity of conducting additional context-specific studies in this area.

Based on the results of thematic and keyword analyses, it can be concluded that the current literature mostly covers themes related to technology, the internet, information, and digital adoption. In contrast, such concepts as digital inequality, internet usage, and digital divide have not received significant attention despite the increasing relevance of these concepts to providing equal access to the digital world. Also, the recent emergence of digital literacy and digital economy as trending themes indicates the shifting focus of research toward exploring the impact of digital skills and digital competences.

Additionally, the results show that even though a lot of effort has been put into studying the determinants of digital inclusion, not many scholars have analyzed how digital technologies have affected financial inclusion, economic empowerment, and sustainable rural development in the long run. Furthermore, most of the literature available today is either focused on one country or technology; hence, there is a need for cross-country and longitudinal studies.

Consequently, future studies should concentrate on neglected areas and also analyze how effective digital inclusion strategies are in addressing the rural-urban digital gap. Another important area for future studies will be analyzing the impact of emerging technologies such as artificial intelligence, digital banking, and FinTech on digital disparity.

VI. CONCLUSION

This research presents a thorough review of the scientific research about the rural-urban digital divide associated with digital banking, financial inclusion, and financial technologies using a bibliometric review of articles published between 2015 and 2025. It is shown that scientific research is growing year by year, which reflects the rising academic and policy attention to the issue of reducing digital inequalities. In particular, the analysis showed influential authors, journals, countries, and articles that played a role in the development of the topic. Additionally, the results of the keyword, co-word, thematic, and trend analysis revealed that the research focus was shifting from the issues of digital infrastructure and internet connectivity to digital literacy and adoption.

However, there are still some gaps in the literature, including research in developing countries, comparative international research, and the impact of digital technologies on financial inclusion and rural development. Future research is recommended to address these gaps as well as investigate new technologies and policies for fostering an equitable digital transition. This research adds to the existing knowledge by creating a map of the intellectual structure of the field.

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