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Trend Research of Rural Broadcasting on Communication Science Based on Bibliometric Approach

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Abstract: Rural broadcasting is an important tool for providing development-focused messages to rural populations. Research on this topic is necessary for creating informed proposals for rural broadcasting legislation. According to a bibliometric study by Evangelos M. Pallis of Hellenic Mediterranean University, the most common sources of research on rural broadcasting are M/C Journal, IEEE Transactions on Broadcasting, and Media Culture & Society Journal. The most frequently cited phrase in the titles of these studies is "UHF," although it appears only four times. Research on rural broadcasting is most common in China, Thailand, and Nigeria, as indicated by the appearance of these countries in the titles of research studies. According to a word cloud analysis, the most common terms in the titles of these studies are "rural broadcasting" and "radio." These terms appear 62 times in total. Recent research on rural broadcasting has covered a range of topics, including radio, digital, and TV. The most common focus of research in this field is TV.

Keywords: Rural Broadcasting, Bibliometrics, Social Development, Biblioshiny, Vosviewer, Communication.

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1. Introduction

Broadcasting is transmitting information over radio waves from a radio or television station to a distant and near audience through their receivers, which help decode the information. Similarly, broadcasting involves the transmission of information by an organization using its radio or television broadcaster to a large, widespread, diverse audience via its receivers. Over time, this process was found to be a powerful and effective medium for large-scale rural education (Badiru et al., 2016). However, in an evolving and urbanizing world, where rural-to-urban population migration has been taking place for decades, the rural environment is in an increasingly unfavorable situation compared to rural-urban areas. This migration process, which empties villages, not only deprives the most active and dynamic population, but the depopulation also leads to the disappearance of basic services, and this, in turn, promotes rural exodus (Abreu et al., 2022).

The depopulation is also reflected in an increasingly noticeable imbalance between the level of development of rural and non-rural regions. Therefore, indicators such as the risk of poverty or social exclusion are higher in rural areas by 23.9% than in urban areas at 21%. The level of education is higher in urban areas, with 60-80% having a university degree but less than 40% in most rural areas. The level of digital skills among adults is lower in rural areas, with 49% possessing basic or higher skills compared to 63% of the urban population (Eurostat, 2019).

In recent years, academic institutions have placed significant emphasis on rural development. Numerous studies have been conducted on the extent of rural development and poverty, rural governance and territorial functioning, reconstruction, and broadcasting. The pressures and challenges associated with rural development are increasingly coming to the fore, with the stress and challenges becoming significant obstacles to progress for many nations and territories worldwide (Ma et al., 2022).

Broadcasting in rural areas is a powerful and successful tool for educating many people in remote areas. A shift toward more positive attitudes can be brought about in rural regions using radio, which promotes the growth of rural women by teaching them various topics, including banking, children's health, and government policies. The relevance of broadcasting in rural areas as a tool for national development has received much attention from professionals in the field of communication in accordance with research published in 2004 by the United Nations Development Program (UNDP) and the World Bank. The report acknowledged the significance

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of community media as a tool for promoting democratic ideals and economic growth (Santas Tsegyu and Ezekiel S. Asemah, 2013).In most countries, "*rural areas*" refer to regions where people still live traditional lives, which cannot be found in the nation's metropolitan centers (Adamowicz & Zwolinska-Ligaj, 2020). Access to content and the opportunity to contribute are two essential elements of rural broadcasting. Its meaning is determined using the idea of a two-way process involving the interchange of information, perspectives, and opinions gleaned from several sources. This is in addition to the acceptance of various forms of media for use by local communities. Under this agreement, people living in rural areas can formulate and implement plans and policies to guide their progress toward greater prosperity (Santas Tsegyu and Ezekiel S. Asemah, 2013). Rural broadcasting plays a significant role in rural development because it supports the dissemination of information on various issues. However, the survey from preliminary research found that the government has not paid adequate attention to rural or municipal broadcasting. This is due to several factors, including the ownership and commercialization of mass media, the lack of proper communications policies, corruption in government circles, and the exclusion of rural populations from development programs by agencies (Rahmawati, Buchori, & Ghoffar, 2022)(Santas Tsegyu and Ezekiel S. Asemah, 2013). Rural areas tend to benefit from digital connectivity use cases through personal communications, online banking, e-governance, and smart farming. The cost of providing connectivity with traditional solutions is very high due to the lack of commercial feasibility to attract investors. As a result, the development of rural broadcasting is lagging because it is influenced by various factors (Kumar et al., 2022).

For this reason, broadcasting in rural areas is one of the most effective means to communicate with residents on development issues. It aims to ensure that people living in rural areas receive development-oriented messages (Tahara et al., 2004a). Furthermore, it is important to remember that effective communication cannot be carried out without the participation of rural broadcasting to achieve the desired results. Broadcasting in rural regions has become an acceptable medium for reaching rural communities, which are presently still falling behind in accessing events and activities through modern communication devices and tend to have a more urban-oriented focus in terms of the program material being transmitted (Tahara et al., 2004b).

It is essential to compile and analyze the research on rural broadcasting from all over the globe to make well-informed suggestions for implementing relevant legislation in rural areas. Its associated research, in the form of bibliometric analysis, is particularly significant. The purpose of this research is to determine the tendencies in bibliometrics associated with the subject of rural broadcasting. Data published on rural broadcasting over the past 20 years was used to investigate the number of articles. The dataset for the research was obtained from the Dimensions database, which was processed in Bibliometrix and visualized in VOSviewer and R-Tool, respectively (Batubara et al., 2021)(Aria & Cuccurullo, 2017; van Eck & Waltman, 2010).

Bibliographic analysis was the primary tool used to compare the research output of different nations and individual authors in rural broadcasting. The rules and quasi-rules governing scientific endeavors were defined using Price and Bradford's laws of scattering. Furthermore, the clusters of keywords were analyzed using evolutionary analysis to determine the trends and routes used by authors (Purkarthofer et al., 2021; van Eck & Waltman, 2010).

2. Methods

The bibliometric analysis assesses the content of bibliographies using quantitative research methodologies, which are associated with the academic field of library and information sciences. In 1969, Pritchard developed the concept of bibliometric analysis, and this technique, used for data interpretation in a specific field of research, has existed since the 19th century (Batubara et al., 2021; Martínez-López et al., 2018). Bibliometrics helps show the history and the overall state-of-the-art of a particular research field (Ronal Watrianthos et al., 2022), which is accomplished by considering written work as the primary formal communication route between scientists. It is possible to carry out tabulations of the research by year, as well as authors' co-citation and co-authorship analyses of the large volumes of documentation related to the field of interest, when using a bibliometric approach. This is because it enables the performance of more objective and reliable analyses using a bibliometric approach (Gaviria-Marin et al., 2018; Roig-Tierno et al., 2017)(Aria et al., 2020).

Bibliometrics, a free and open-source research tool, was used to handle the results of crawling the Dimensions database, such as scientometrics and bibliometrics. This tool creates a scientific environment map, thereby enabling the identification of research trends and gaps in any topic. The program's free version includes a published search index and links to all other organizations. Rural broadcasting was the center of attention from 2002 to 2022, with an annual growth rate of 6.2% and 303 publications, which left this research with many gaps to examine.

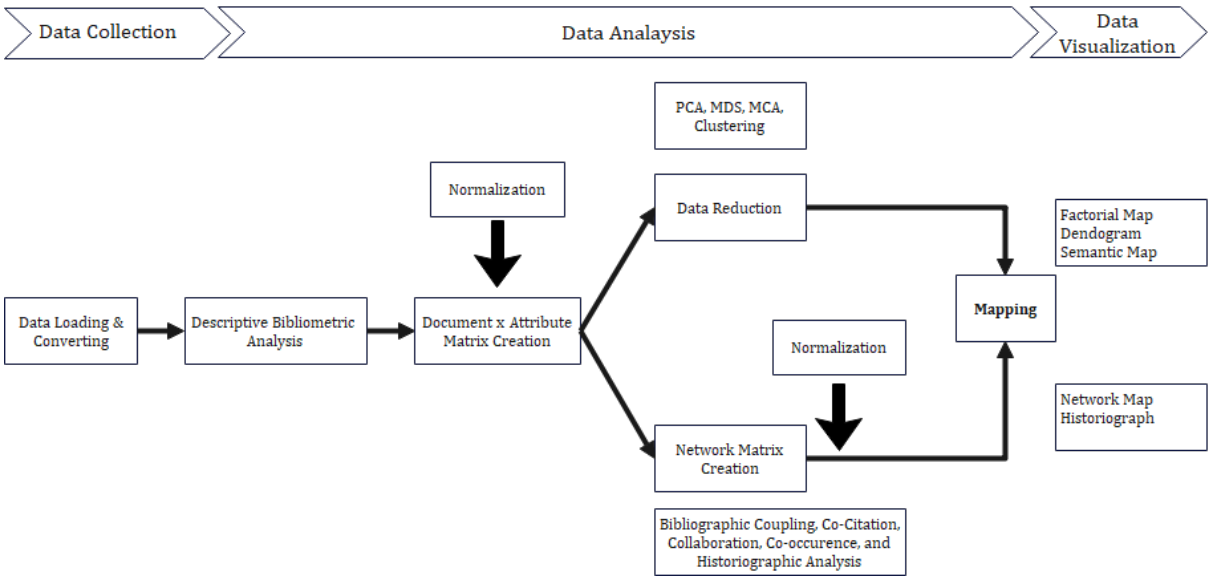


Figure 1: Science mapping workflow using Bibliometrix (Aria & Cuccurullo, 2017)

Figure 1 shows how the bibliometrics' scientific mapping utilizes a dataset obtained from the dimensions, which was translated. The data was then analyzed using the R programming language to ensure it was tweaked and used for various statistical and graphical applications. This research utilized Biblioshiny for the analysis, which makes the mapping procedure more effective and uncomplicated (Aria & Cuccurullo, 2017). Dimensions were selected to guarantee the comprehensiveness and credibility of the data source retrieved from preliminary research shown in Table 1. The Dimensions database is one of the most serious competitors of the Web of Science and Scopus databases. Recent research suggested it is an alternative to existing databases (Singh et al., 2021; Thelwall, 2018).

Table 1: Summary of data source and selection

Category	Specific Requirements
Research database	Dimensions
Searching period	2002-2022
Language	English
Searching keywords	Rural AND Broadcasting
Documents type	"*Articles*" or "*Proceeding*" or "*Chapter*"
Data extraction	Export with full records and cited references in CSV format
Sample size	303

The subject areas and research trends were determined based on the results of bibliometric mapping from the existing literature. VOSviewer was used to visualize bibliographic information by analyzing the co-occurrence of keywords and the authors in connection to worldwide rural broadcasting from 2002 to 2022. This was carried out to identify the direction of the current research (van Eck & Waltman, 2010).

3. Results And Discussion

The search phrases "*rural broadcasting*" and the frame period from 2002 to 2022 were used as the criteria for constructing a dataset taken from the Dimensions database. The essential parts of this data are condensed and summarized in Table 2.

Table 2: Basic Data and Critical Information

Description	Information
Timespan	2002:2022
Sources (Journal, Article, Proceeding)	252
Documents	303
Years on average since the publication	8.03
Average citations per document	4.85
Citations received on average by each document every year	0.63
Authors	758
Authors of single-authored documents	95
Authors of multi-authored documents	663

Description	Information
Single-authored documents	99
Authors per Document	2.5
Co-Authors per Documents	2.86
Collaboration Index	3.27

3.1 Analysis Of The Author

The authors of scientific articles constitute the majority of scientific effort and output, with an average of 2.5 per piece, as indicated by statistical analyses. Therefore, this research used Price's law to investigate the distribution of production efficiency by field professionals (Luo et al., 2022).

Table 3: Top Ten Authors

No	Name	Affiliations	Papers	Citations	Citations Mean
1	Evangelos M Pallis	Hellenic Mediterranean University, Greece	7	55	7.86
2	Evangelos K Markakis	Hellenic Mediterranean University, Greece	4	18	4.50
3	Mauro Fadda	University of Sassari, Italy	4	72	18.00
4	Maurizio Murroni	University of Cagliari, Italy	4	72	18.00
5	Vlad Popescu	Transylvania University of Brașov, Romania	4	72	18.00
6	Vassilios G Zacharopoulos	Hellenic Mediterranean University, Greece	4	36	9.00
7	Myoung-Won Jung	Electronics and Telecommunications Research Institute, South Korea	4	10	2.50
8	David Plets	Ghent University, Belgium	3	20	6.67
9	Luc C Martens	Ghent University, Belgium	3	20	6.67
10	Moshe Timothy Masonta	Council for Scientific and Industrial Research, South Africa	3	38	12.67

Table 3 shows a list of the ten most prolific authors in this field, utilized to better understand the productive academics who have worked on this subject over the last two decades. According to the data, Evangelos M Pallis of the Hellenic Mediterranean University in Greece had a high scientific output and significant recognition. Furthermore, Evangelos referenced 55 works, with an average of 7.86 citations each. The number of citations for each article was calculated using the keywords included in this research. The following ten publications obtained the most citations overall, as shown in Table 4.

Table 4: Articles with the highest citation

No	Citation	Author	Title	Journal
1	87	Brennan S, 2004 (Brennan et al., 2004)	"*Radiation detection with distributed sensor networks*"	IEEE Xplore
2	83	Gómez-Barquero D, 2014 (Gomez-Barquero et al., 2014)	"*DVB-NGH: The Next Generation of Digital Broadcast Services to Handheld Devices*"	IEEE Xplore
3	70	Jiménez F, 2016 (Jiménez et al., 2016)	"*Advanced Driver Assistance System for Road Environments to Improve Safety and Efficiency*"	Transportation Research Procedia
4	55	Liang Y, 2008 (Ying-Chang Liang et al., 2008a)	"*Cognitive radio on TV bands: a new approach to provide wireless connectivity for rural areas.*"	IEEE Xplore
5	52	Serwaa D, 2020 (Serwaa et al., 2020)	"*Knowledge, risk perception and preparedness towards coronavirus disease-2019 (COVID-19) outbreak*	Pan African Medical Journal

No	Citation	Author	Title	Journal
			among Ghanaians: a quick online cross-sectional survey."	
6	42	Zhou H, 2016 (Zhou & Pan, 2016)	"*Information, Community, and Action on Sina-Weibo: How Chinese Philanthropic NGOs Use Social Media*"	VOLUNTAS: International Journal of Voluntary and Nonprofit Organizations
7	38	Sagar S, 2018 (Sagar et al., 2018)	"*Comparison of radiofrequency electromagnetic field exposure levels in different everyday microenvironments in an international context*"	Environment International
8	36	Lwoga ET, 2010 (Lwoga, 2010)	"*Bridging the Agricultural Knowledge and Information Divide: The Case of Selected Telecenters and Rural Radio in Tanzania*"	The Electronic Journal of Information Systems in Developing Countries (EJISDC)
9	34	Sagar S, 2016 (Sagar et al., 2016)	"*Use of portable exposimeters to monitor radiofrequency electromagnetic field exposure in the everyday environment*"	Environmental Research
10	33	Fadda M, 2015 (Fadda et al., 2015)	"*On the Feasibility of Unlicensed Communications in the TV White Space: Field Measurements in the UHF Band*"	International Journal of Digital Multimedia Broadcasting

Scientific collaboration occurs when two or more scientists work together in a social setting to help each other understand and complete tasks related to their predetermined goal. Scientists are encouraged to work together to discover something new because research is becoming more specialized, with more complicated infrastructure and the need to combine different kinds of knowledge and skills to solve complex health problems. Scientific cooperation could help broaden the scope of research and promote new ideas by providing authors access to external fields (Fonseca et al., 2016).

The most significant levels of reciprocal publishing and the fruitful collections of publications were evaluated by co-authorship. A bibliometric network was used to represent the interactions between these groups by plotting the number of publications jointly written by each author, institution, and nation. Furthermore, authors' names were used to create a bibliometric co-authorship map in VOSviewer, and the results are shown in Figure 2. A group of nodes that works together as a unit is called a cluster, and each network node belongs to one cluster (Anjum et al., 2020).

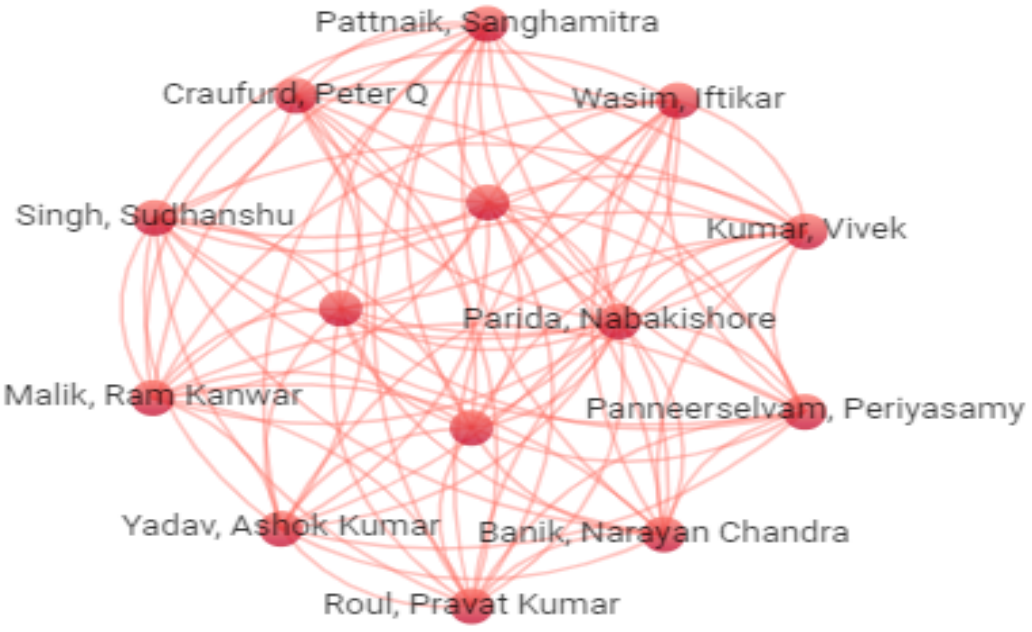


Figure 2: Co-authorship analysis

Figure 2 shows that only 14 of the 758 authors in the representative worked with one another in a cluster leading to 91 co-authorships. This demonstrates that the authors' contributions are not of worldwide significance.

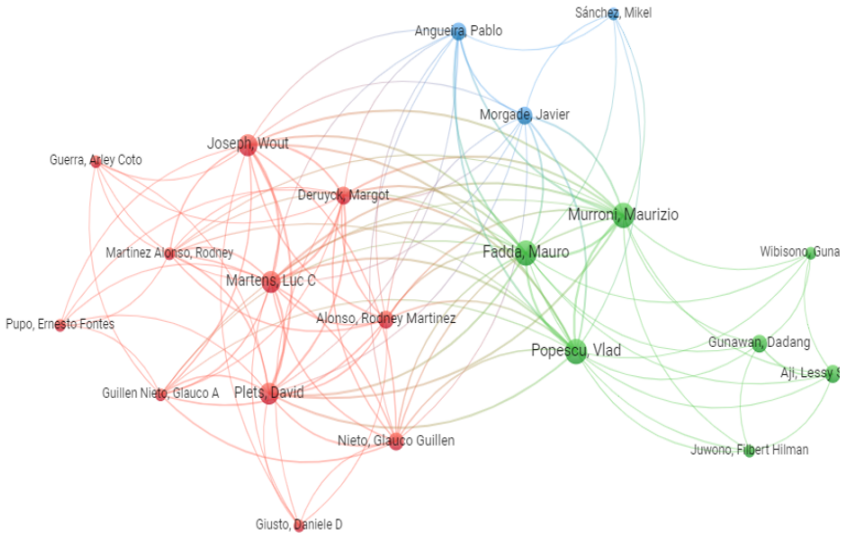


Figure 3: Citation analysis

Meanwhile, three clusters of authors mentioned each other based on the number of citation times, and they amalgamated into 21 authors. Those with the same number of citations in a cluster are Mauro Fadda, Vlad Popescu, and Maurizzo Murroni from the University of Sassari, Transylvania University of Brașov, and the University of Cagliari, respectively. These three authors illustrated their teamwork by quoting one another.

3.2 Journal Analysis

Periodicals are vital to this research and analysis because they include scientific knowledge. According to the data, the M/C journal has the most articles on urban broadcasting, followed by the IEEE Transactions on Broadcasting and the Media Culture & Society Journal of the journals used as library resources. Bradford's scattering law is an example of a classical analytical law used in bibliometrics to classify and identify core journals (Desai et al., 2018) .

This theorem asserts that the quantity distribution of professional documents in associated journals has asymmetric and oblique distribution with a definite quantity that links professional papers and their corresponding journals. Moreover, the in-depth analysis of these journals makes it feasible to distinguish between the "*core*," where most articles were published, and the "*subsequent*" regions (Venable et al., 2016).

Table 5: Source Clustering Through Bradford's Law

Zone	Ranking	Number of Journals	Number of Publications
Zone 1	1-49	49	100
Zone 2	50-153	104	104
Zone 3	154-252	99	99

Research related to rural broadcasting classifies journals into distinct areas from the total number of publications, as shown in Table 5. Currently, each of the three zones has almost the same number of publications, with the M/C Journal as the core in this field based on Bradford's law of document distribution. However, other journals located in relevant areas, such as IEEE Transactions on Broadcasting, should be considered part of this field.

Table 6: Impact measure-based h-index

Ranking	Journal	H-Index	G - Index	Total Citation	Number Publication
1	IEEE Transactions on Broadcasting	6	8	161	8
2	Media Culture & Society	5	5	66	5
3	Media International Australia	3	3	12	4
4	Journal of Radio Research	2	2	18	2
5	M/C Journal	2	3	14	8

The h-index, created by physicist Hirsch (2005), is a measure of both quality (number of citations) and quantity (number of publications). Hirsch stated that when an entity has X articles, with each mentioned at least X times, its h-index value is X. Therefore, a journal's h-index would be 20, assuming 20 articles were referenced at least 20 times. An h-index of 10 indicates that 10 articles were referenced at least 10 times in some fields, such as social work; hence, the h-index is a more accurate indicator of journal quality. The h-index captures the quality and quantity of a single value that is intuitively understandable (Hodge & Lacasse, 2011). The journals in the field with the most outstanding caliber can be determined by conducting further research on the citations of published articles. Based on each paper's total citations, the top five publications in this field are ranked in Table 6, with IEEE Transactions on Broadcasting cited 161 times. IEEE is a well-regarded publication in this area of research and has published substantial scientific research.

3.3 Country Analysis

Collaboration networks are a subset of social networks in which nodes represent people who cooperate in specific projects, employment, and scientific articles. The collaborative environment is any organization, institution, academic community, or nation examined to evaluate the relationship quality between cooperation networks and determine significant network players and groups that are tightly linked. These factors are crucial for analyzing the information exchange across players and recommending future moves and actions (Meštrović, 2018).

Figure 4: Collaboration network by country

Network visualization analysis was used to represent the social relationships between authors' countries within the rural broadcasting research. The analysis unit was used to represent the social interaction between 57 authors by selecting three minimum numbers of documents from 15 in four clusters, namely red, green, blue, and yellow. FIGURE 4 shows that 25 countries have been divided into four clusters, where the red cluster consists of Canada, Italy, Romania, and Spain. The green cluster comprises Australia, India, South Africa, and the United States. The blue cluster is France, Greece, and the United States, while the yellow cluster is Indonesia and Malaysia. Each cluster showed social relationships between authors' countries; for example, the green cluster represents authors in the United States, Australia, India, and South Africa who have social interactions in conducting research and publishing documents related to rural broadcasting.

Table 7: Country Scientific Production

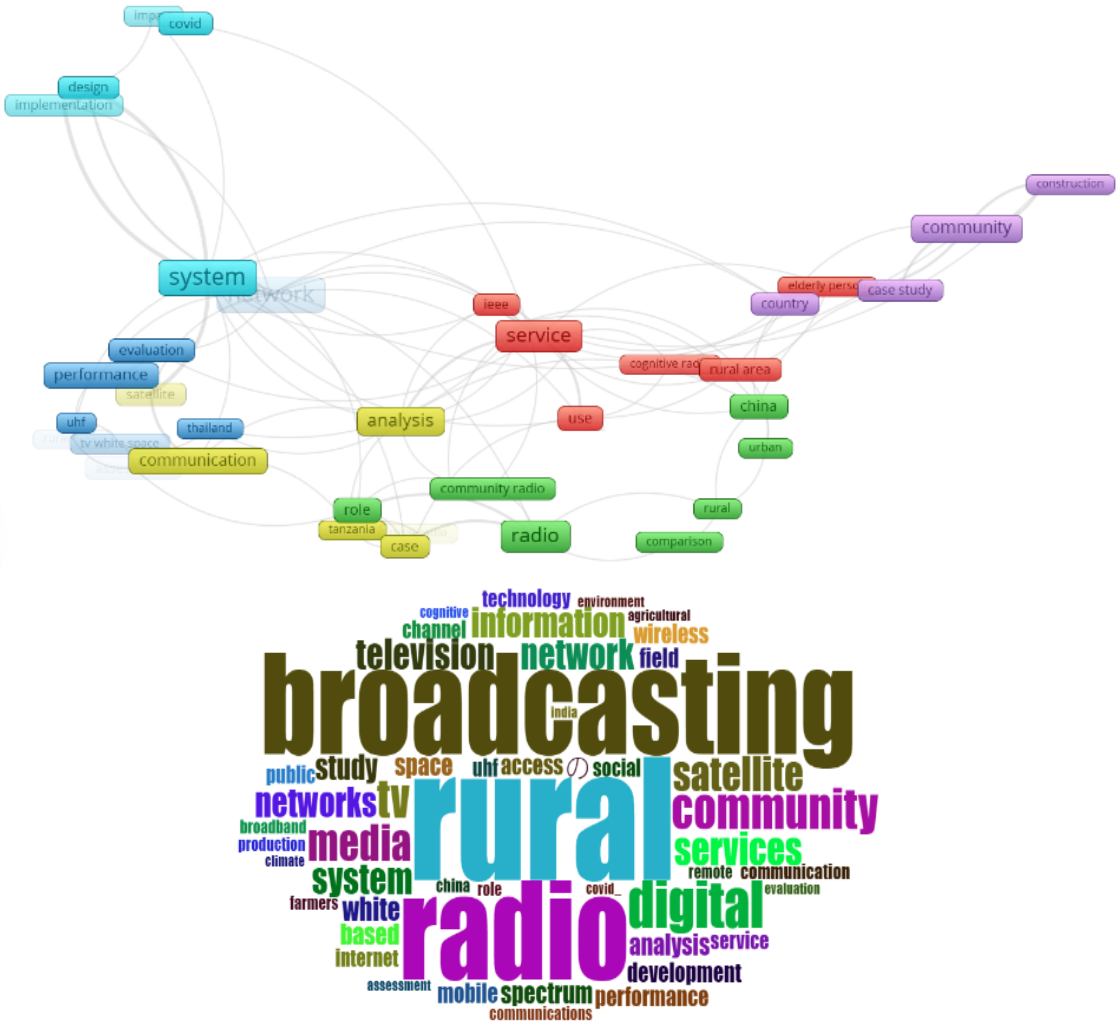
Cluster	Country	Articles	Total Link Strength	Citations	Average Article Citations
1	Canada	7	1	42	7
1	Italy	8	6	11	3.66
1	Romania	5	6	64	16
1	Spain	7	7	153	76.50
2	United States	23	6	37	2.64
2	Australia	17	3	66	4.40
2	India	18	5	35	2.91
2	South Africa	6	2	41	8.20
3	France	5	5	1	1
3	Greece	8	2	71	8.87
3	United Kingdom	10	4	54	7.71
4	Indonesia	6	1	1	0.16
4	Malaysia	5	2	14	4.66

The table shows that authors in Spain had the most extensive network research related to rural broadcasting, with only 7 articles and 153 citations, as well as the highest overall link strength score in Cluster 1. Interestingly, the United States' most prolific authors are in cluster 2, which is equal in overall connection strength with Italy and Romania.

3.4 Research Trend

Keywords extract the essence and content of a document; therefore, using word co-occurrence analysis, a research hotspot in the scientific field was determined. This research used the VOSviewer to generate a keyword co-

occurrence map for 303 publications and selected 43 critical keywords from titles with a frequency greater than or equal to three for visualization, as shown in Figure 5. The frequency of the occurrence of keywords is proportional to the size of the circular node in Figure 5, where the connection indicates the relationship's strength. The greater the strength of the connection, the greater the number of times it occurs in the exact text.



Figures 5 & 6: Co-occurrence term map and word cloud based on the title.

Figures 5& 6 show the co-occurrence of word title visualization and the word cloud. The term 'UHF,' which appeared four times, is the most pertinent in the title. This picture has the phrases 'China, 'Thailand,' and 'Nigeria,' suggesting that rural broadcasting-related research is conducted mainly in these three countries. The most common words in the title, according to the word cloud, were "*rural*," "*broadcasting*," and "*radio*," with 62, 52, and 50 appearances, respectively. Regarding the research topics in this analysis, radio, digital, and television have become the topics that many authors have studied in relation to rural broadcasting.

This is in line with the research by Evangelos Pallis, which used a high scientific output and reputation in the field to describe the overall architecture of a fusion environment that can merge broadcast, internet, and telecom into a single and shared infrastructure to provide access to triple-Enable Play services and connectivity in both urban and rural areas (Mastorakis et al., 2007). Figure 5 shows the research type that is closely related to wireless radio broadcasting in rural areas. This is consistent with research by Liang Y (Ying-Chang Liang et al., 2008b), which states that the application of wireless technology to provide connectivity for rural areas is a topic of active discussion in the academic and industrial sectors. The IEEE 802.22 standard, currently under development, is the most notable candidate for rural cognitive radio technology based on time division duplex, orthogonal frequency division multiple access, and opportunistic use of the VHF/UHF TV bands. This standard is a service model that combines television broadcasting and data services to support the growth of rural connectivity demand.

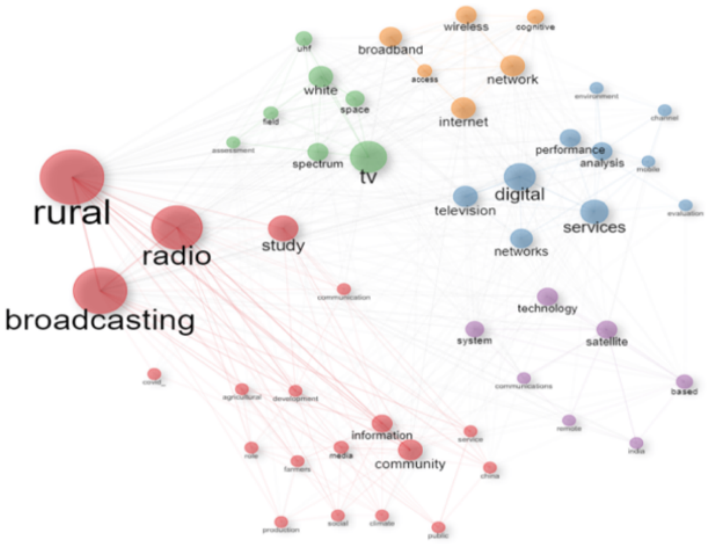


Figure 7: Thematic map in rural broadcasting

The thematic map depicts the geographic distributions, which are often demographic, sociological, cultural, and economic. The well-known thematic map is the choropleth, which colors areas based on the distribution of a data variable and is produced by mapping data to many aesthetics per layer. Additionally, it is used to produce small multiples by modifying the map layout and adding elements, such as a scale bar and compass (Tennekes, 2018). Figure 7 depicts the rural broadcasting thematic map with five significant clusters, namely digital, satellite, rural, network, and television. The main clusters contain broadcast media, such as radio, which have often been referenced in rural broadcasting research.

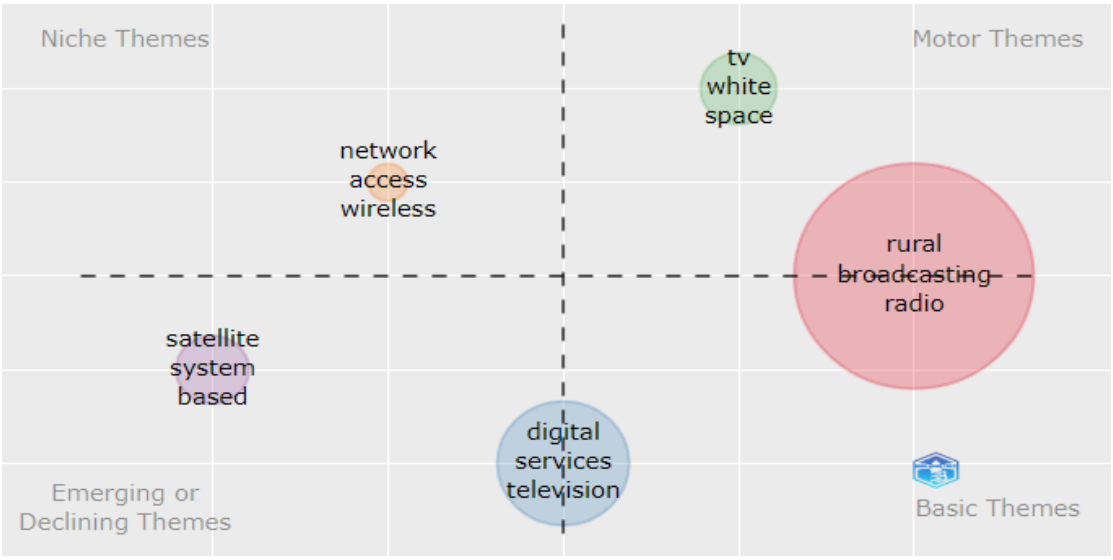


Figure 8: Thematic evolution in rural broadcasting.

The co-word analysis results are presented as keyword clusters, used to identify the density and centrality of themes and map them in a diagram with just two dimensions. A thematic map is a very intuitive plot analyzed according to the quadrant in which the co-words are placed. Meanwhile, motor themes are located in the upper-right quadrant and used to define hot topics that are well-developed and relevant for structuring the conceptual framework of the domain. Basic themes are located in the lower-right quadrant and define basic topics that are significant for the domain and crosscutting to its different areas. Finally, emerging or disappearing themes are located in the lower-left quadrant and define important peripheral topics that are not fully developed or marginally interesting for the domain (Aria & Cuccurullo, 2017; Aria et al., 2020, 2022).

Four significant themes emerged in the thematic progression, as shown in Figure 8, with a variety of terminology linked to rural broadcasting used to define the research topic. The figure depicted "*TV*" as the primary subject of rural broadcasting topics, while "*digital*," "*service*," and "*television*" emerged as a general theme in the lower-right quadrant, along with the topic's several application fields. The words "*satellite*," "*system*," and "*based*"

showed a declining theme on the left, with low density and centrality. This second argument is supported by the words "*network*," "*access*," and "*wireless*" in the upper-left quadrant as a niche of the time, with a high density but low centrality.

These results clearly illustrated that in the age of information and communication technologies (ICT), traditional mass media, such as radio, television, and newspapers, are still able to influence socio-cultural changes in rural communities. Research conducted in rural parts of Arunachal Pradesh concluded that mass media is essential for any form of development in a community, and radio is seen as the heart and soul of rural people to bring development to villages. In current culture, where ICT influence many aspects of life, radio plays an equally important role in bringing about the transition from traditional to modern society in rural areas. People continue to select radio as the main source for news broadcasts in both urban and rural areas, thereby making it impossible to overlook its important role in modern society (Devi et al., 2022).

4. Conclusions

The dissemination and transmission of social development programs to benefit the behavior of persons living in rural regions are referred to as "*rural broadcasting*". Consequently, broadcasting in rural regions is one of the most efficient ways to connect with the inhabitants and obtain the right information regarding concerns about development. This research indicated that Evangelos M. Pallis of the Hellenic Mediterranean University in Greece possesses significant scientific output with a high level of recognition due to the publication of 55 works to his name, with an average of 7.86 citations per piece of literature. In terms of publications that are used as resources inside the library, the M/C journal has the greatest number of articles on urban broadcasting. This was followed by IEEE Transactions on Broadcasting and the Media Culture and Society Journal. The term "*UHF*" significantly contributes to the title, even though it appears only a total of four times. The phrases "*China*," "*Thailand*," and "*Nigeria*" make one assume that the majority of research dealing with rural broadcasting is carried out in these three countries, but this was not the case. In recent years, several authors have been interested in rural broadcasting as a subject for their research, with a focus on various areas of the medium, including radio, digital technology, and television. The term "*TV*" was included in the graphic as an essential component of rural broadcasting concerns since it was the most prevalent form of media in rural areas.

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