# USING VOSVIEWER FOR A BIBLIOMETRIC COMPUTATIONAL MAPPING ANALYSIS OF PUBLICATIONS ON COMMUNICATION TECHNOLOGY

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## Abstract

This study aims to examine the development of communication technology research through a bibliometric approach with computational mapping analysis using VOSviewer. The Publish or Perish reference manager application was used to obtain the article data from the Google Scholar database. The title and abstract of the article are used to guide the search process by referring to the keyword "communication technology". Discovered 348 relevant articles that Google Scholar has indexed over the past ten years (from 2012 to 2021). According to the findings, communication technology research can be broken down into three categories: technology, communication, and communication technology. There are 76 links with the term "communication" and a total link strength of 755. The term "technology" has 75 links with a total link strength of 724. While the term "communication technology" has 69 links with a total link strength of 418. The analysis of the development of publications over the past ten years' results reveals frequent fluctuations. It went from 67 studies in 2012 to 43 in 2013. From 2013 to 2019, there were research fluctuations (sequentially 43, 49, 42, 37, 41, 20, 23). There was a decrease from 23 to 8 between 2019 and 2021. In the meantime, 67 studies on popular communication technologies were conducted in 2012. Using VOSviewer, we counted the number of articles on communication technology and its connection to other fields. The findings of this research analysis may serve as a foundation for additional material-related research.

Keywords: Bibliometric, Communication technology, Computational mapping analysis, VOSviewer.

## 1. Introduction

Everybody needs to engage in activities of communication, both within and outside the organization [1-5]. Humans should communicate with others to socialize and exchange information because they are social beings. Essentially, communication takes place face-to-face between the sender (the communicator) and the receiver (the communicant).

However, over time, technology in the form of tools and applications that facilitate communication between individuals is increasingly being utilized and facilitating a variety of processes, including those in professional organizations and those in the community.

Individual interactions as a result of COVID-19, which makes face-to-face communication less important, necessitate the use of this technology for communication [6]. That is the main reason for the improvement how to communicate, especially relating to teaching and learning process during and past covid-19 pandemic [7-11].

Currently, the development of communication technology has grown rapidly. This is in line with the need for more intense communication and efficiency in coordination, both for problem-solving and decision-making needs [12-14]. Communication technology has a practical influence on communication, especially regarding new media. One of the effects is a change in the way of communicating. Technology is vital in several communication approaches, so the two have a sustainable relationship. The use of technology in the form of media can be defined into changing signs that will become messages in communication [15].

Bibliometric analysis is an analytical method that can be utilized to discover the progress of communication technology research. A type of meta-analysis of research data known as bibliographic analysis can help researchers in examining the bibliographic content and analysing citations from journal articles and other scientific works. Bibliometric analysis has been the subject of numerous studies, including those in economics [16-19], bibliometric analysis in the medical field [20], chemical research [21], chemical engineering [22-24], marketing [25] and strategic management [26], Vocational High School [27], Scientific Publications [28], Education for Special Needs [29], Economic Technology Education Publications [30], Machine Performance [31], Applications in hand systems for robots [32], Educational Research [33], Bioenergy Management [34], Magnetite Nanoparticles [35], Research on the Production of Nanocrystalline Cellulose [36], Nano Metal-Organic Synthesis Framework [37], and Big Data [38].

However, there has not been any research on shooting bibliometric analysis of data in communication technology that specifically aims to determine the development of research. Especially bibliometric analysis using the VOSviewer application for research conducted in the past ten years, from 2012 to 2021.

Therefore, the purpose of this study was to use VOSviewer software to conduct computational research on mapping bibliometric analysis of Google Scholar-indexed articles. This study aims to provide researchers, particularly those working in the field of communication technology, with a resource for determining the topic and carrying out subsequent research.

The development of research on communication technology using computational bibliometric mapping is important at this time. By knowing the results of computational bibliometric mapping analysis in the field of communication technology, we can know the development of communication technology research until now and know the terms that are commonly associated with the topic of communication technology. Thus, this can make it easier to carry out research development related to communication technology and seek novelty in research.

## 2. Theory

Nowadays, the study of communication is becoming increasingly dynamic. This is a result of improvements in communication technology. Technology and communication have an ongoing relationship because technology is essential to numerous communication approaches. Communication technology is a tool inside an organizational framework that enables people to gather, process, and share information with one another. This demonstrates that communication technology is characterised by a number of factors, including its relationship to hardware or instruments, its emergence within a particular political, social, and economic framework, and its adoption of specific values from that framework. The term "new media" was coined as a result of the advancement of communication technology [15].

A communication and information technology network, or new media, is a tool for delivering messages to a large audience via digital technology. People can now create, alter, and distribute new media with relatively inexpensive tools. A computer or mobile device with internet access is required for new media. The existence of new media in all of its manifestations and functions does not merely alter conventional media. The community still relies on traditional media as a means of obtaining information tailored to its particular characteristics. In terms of how they are used individually, there is a clear distinction between new and old media. The level of freedom in the use of media, as well as the high level of privacy associated with the use of new media, are more individual and do not involve direct social interaction.

Communication technology has many contributions to other fields of science, one of which is in the field of education, namely learning technology which includes aspects of information and telecommunications infrastructure as well as human resources [39-44]. Thus, they can play a role in the learning process with various learning resources.

There are at least two roles that information and communication technology (ICT) can play in education: as a catalyst for the educational community to become more appreciative and proactive in maximizing educational potential and as a broad opportunity for students to take advantage of every potential through information from an unlimited number of sources [15, 45-50].

Information is important now. The right to obtain information exists for all levels of society to develop and interact with. As a result, the importance of information as a source of knowledge, comprehension, and awareness of the world around us makes it one of the most essential needs of humans. As a means of distributing information, information networks must be constructed and developed.

Communication technology advancements may make it simpler to meet the community's information requirements.

## 3. Method

This study relied on research that has been published in Google Scholar-indexed journals for the article data. Because the Google Scholar database is open source, we decided to use it in this study. An application to manage references called Publish or Perish is used to collect research data. A literature review on the subjects we chose was carried out with the help of the software called Publish or Perish. Husaeni and Nandiyanto's research [51] provides detailed instructions for using software and installing it, as well as a step-by-step procedure for obtaining data. A previous study by Azizah et al. [52] provides detailed directions for using Google Scholar to search for data in libraries.

There were several stages to the research:

(i)   Collecting publication data with Publish or Perish application,

(ii)  Processing bibliometric data for articles with Microsoft Excel application,

(iii) Utilizing the VOSviewer application for computational mapping analysis of bibliometric published data, and

(iv)  Examining the results of computational mapping

In Publish or Perish, the search for article data is used to filter publications based on the title's criteria using the keyword "communication technology". The used papers were published from 2012 to 2021. In September 2022, all of the data were gathered. The articles that had been gathered and that met the requirements for the research analysis were then transferred into two different kinds of files: comma-separated value format (*.csv) and the research information system (.ris). Utilizing bibliometric maps, trends can also be visualized and evaluated with VOSviewer. The source database's article data is then mapped.

Network-based overlay visualisation (co-citation) between already-existing things, network visualisation, and density visualisation are the three types of mapping publications that can be created using VOSviewer. The keyword frequency in a bibliometric map must be discovered at least three times. Consequently, 77 less relevant terms and keywords are removed.

## 4. Results and Discussion

### 4.1. Publication data search results

348 article data that met the research criteria were found by searching the Google Scholar database utilizing the Publish or Perish application reference manager. The author's name, journal name, title, year, publisher, number of citations, article links, and related URLs are the article metadata that were obtained. Some examples of published data utilized in this study's VOSviewer analysis are presented in Table 1. The 10 best articles with the most citations were used as the data samples. All of the articles used in this study have 55,689 citations, 5568.90 citations per year, 159.11 citations per article, an average author of 2.67, an h-index of 136, and a g-index of 218 for all of them.

**Table 1. Communication technology publication data.**

| No. | Authors | Title | Year | Cites |
|---|---|---|---|---|
| 1 | Carr and Hayes | Social media: Defining, developing, and divining | 2015 | 1132 |
| 2 | Williams et al. | The unified theory of acceptance and use of technology (UTAUT): a literature review | 2015 | 1009 |
| 3 | Chick et al. | Using technology to maintain the education of residents during the COVID-19 pandemic | 2020 | 982 |
| 4 | Silva et al. | Mobile-health: A review of current state in 2015 | 2015 | 915 |
| 5 | Wirtz et al. | Brave new world: service robots in the frontline | 2018 | 889 |
| 6 | Alshamaila et al. | Cloud computing adoption by SMEs in the north east of England: A multi-perspective framework | 2013 | 880 |
| 7 | Bennett and Livingston | The disinformation order: Disruptive communication and the decline of democratic institutions | 2018 | 853 |
| 8 | Cresswell and Sheikh | Organizational issues in the implementation and adoption of health information technology innovations: an interpretative review | 2013 | 655 |
| 9 | Gagnon et al. | Systematic review of factors influencing the adoption of information and communication technologies by healthcare professionals | 2012 | 603 |
| 10 | Lee and Coughlin | PERSPECTIVE: Older adults' adoption of technology: an integrated approach to identifying determinants and barriers | 2015 | 569 |

## 4.2. Research development in the field of communication technology

The progression of communication technology research that has been published in the Google Scholar-indexed journal is depicted in Table 2. From 2012 to 2021, there were 348 articles published in the field of communication technology, according to the data in Table 2. There were 67 research articles in 2012, 43 articles in 2013, 49 articles in 2014, 42 articles in 2015, 37 articles in 2016, 41 articles in 2017, 20 articles in 2018, 23 articles in 2019, 18 articles in 2020, and 8 articles in 2021. According to the number of publications, communication technology research is still relatively rare every year, particularly in the last ten years (2012-2021). Figure 1 shows that its development is also quite volatile.

The progression of communication technology research from 2012 to 2021, is depicted in Fig. 1. Figure 1 reveals that, between 2012 and 2013, there was a decrease in research on communication technology. The fact that there were 67 articles published in 2012 and only 43 in 2013 demonstrates this decline. Between 2013 and 2019, the amount of research done on communication technology varied, but in the last two years, there have been as few as 18 articles in 2020 and as many as 8 in 2021. According to the data, interest in research on communication technology has decreased because communication technology research tends to be new and unstable.

**Table 2. The development of communication technology research.**

| Year of Publications | Number of Publications |
|---|---|
| 2012 | 67 |
| 2013 | 43 |
| 2014 | 49 |
| 2015 | 42 |
| 2016 | 37 |
| 2017 | 41 |
| 2018 | 20 |
| 2019 | 23 |
| 2020 | 18 |
| 2021 | 8 |
| Total | 348 |
| Average | 34.8 |
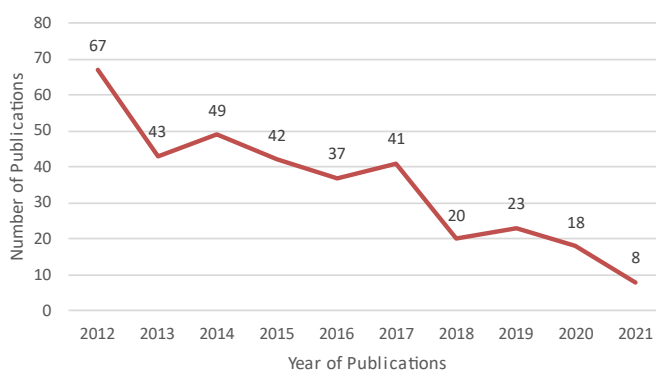


**Fig. 1. Development level of communication technology research.**

### 4.3. Visualization of communication technology topic areas using VOSviewer

On the article data, computational mapping was carried out. Computational mapping makes use of VOSviewer. 77 items were discovered from the computational mapping results. Data mapping divides each item related to communication technology into six clusters:

(i)     Cluster 1 has 15 items and is marked in red; the 15 items are ability, application, knowledge, management, office, organizations, paper, part, project, research, resource, service, support, type, and value.

(ii)     Cluster 2 has 14 items and is marked in green, the 14 items are communication technology, communications technology, cost, development, effort, ICT, impact, information, internet, number, relationship, study, technology, and working.

(iii)     Cluster 3 has 13 items and is marked in blue, the 13 items are adoption, barrier, effect, effective communication, health information technology, implication, opportunity, patient, person, practice, review, systematic review, and use.

(iv)     Cluster 4 has 13 items and is marked in yellow; the 13 items are benefit, case study, challenge, cloud computing, collaboration, example, factor, implementation, innovation, interaction, level, new technology, and workplace.

(v)   Cluster 5 has 11 items and is marked in purple, the 11 items are business, change, communication, evolution, framework, influence, information technology, internal communication, process, role, and social medium.

(vi)   Cluster 6 has 11 items and is marked in sky blue; the 11 items are COVID-19, digital technology, employee, form, industry, mobile technology, organization, pandemic, task, way, and work.

In each cluster that is currently in place, the connection that exists between two terms is shown. Each term is given a label employing coloured circles. The frequency with which each term occurs influences the size of the circle for that term [23]. There is a positive correlation between the number of terms in the title and abstract and the size of the label circle. The label size is larger the more frequently the term is found [51]. There are three parts to the mapping visualization analysed in this study: visualizations of the network (see Fig. 2), density (see Fig. 3), and overlay (see Fig. 4) [53].
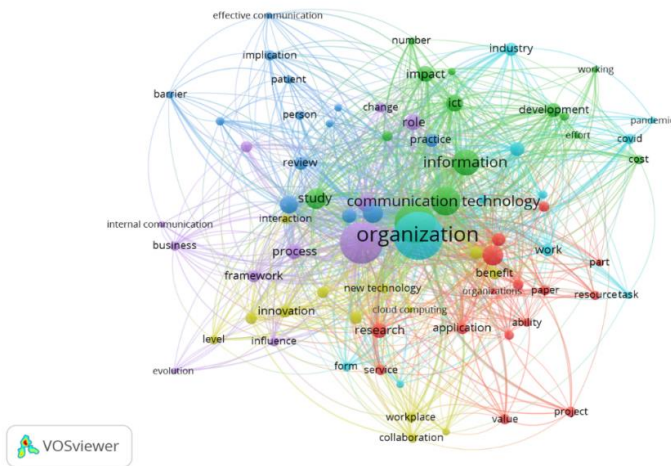


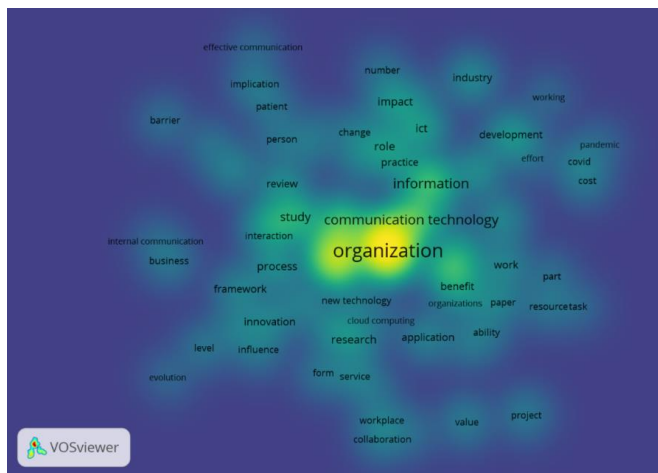**Fig. 2. Network visualization of communication technology keyword.**



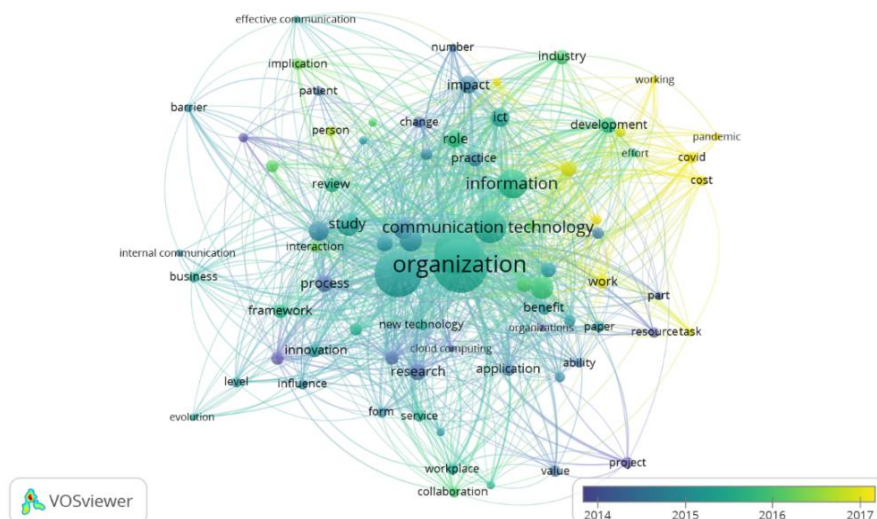**Fig. 3. Density visualization of communication technology keyword.**

**Fig. 4. Overlay visualization of communication technology keyword.**

The connection between terms is shown in Fig. 2. An interconnected network is used to describe the relationship between terms. The clusters of each term that are frequently studied and connected to the communication technology research topic are depicted in Fig. 2. Research on communication technology can be broken down into three categories according to the clusters in the network visualization. The communication term is in cluster 5 with 76 links, 755 total link strength, with 182 occurrences (see Fig. 5). The second term is a technology which is part of cluster 2 and has 75 links, a total link strength of 724, with 166 occurrences (see Fig. 6). The third term is communication technology that is part of cluster 2, has 69 links, a total link strength of 418, with 88 occurrences (see Fig. 7).
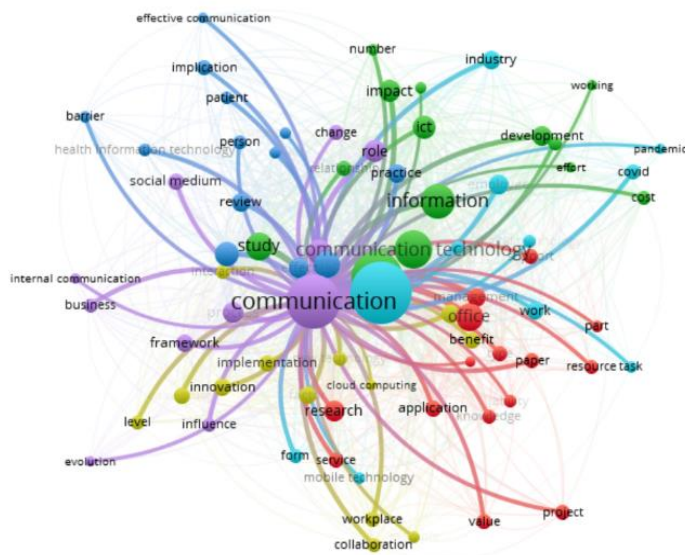


**Fig. 5. Network visualization of communication term.**

**Fig. 6. Network visualization of technology term.**



**Fig. 7. Network visualization of communication technology term.**

The visualization of density is shown in Fig. 3. According to density visualization, the term label appears more frequently the brighter the yellow colour and the larger the circle diameter [23, 28, 54]. This indicates that numerous studies on related terms have been conducted. On the contrary, the number of studies on the term is small if its colour fades close to the background colour. Figure 3 shows that there are a lot of studies on the topics of office, communication technology, organization, information, and study.

In research on communication technologies, the overlay visualization is depicted in Fig. 4. The newness of research on related terms is demonstrated by this visualization overlay [23, 51, 53]. Figure 4, which is clarified in Fig. 8, demonstrates that the majority of research on communication, technology, and communication technology was conducted between 2015 and 2016. The terms "communication," "technology," and "communication technology" have been around for a very long time in research. As a result, we can easily conduct fresh research on the term.

Figure 5 shows a network of communication relationships with other terms, namely business, change, evolution, framework, influence, internal communication, role, social medium, barrier, effective communication, implication, patient, person, practice, review, cost, development, effort, ICT, impact, information, number, study, working, covid, form, industry, pandemic, task, work, application, office, paper, part, project, research, resource, service, value, benefit, cloud computing, collaboration, implementation, innovation, level, and workplace.

Figure 6 depicts the network of connections between the term technology and existing terms, including communication technology, cost, development, effort, ICT, impact, information, number, study, working, covid, form, industry, task, work, application, office, paper, part, project, research, resource, service, value, benefit, cloud computing, collaboration, implementation, innovation, level, workplace, business, change, evolution, framework, influence, internal communication, role, social medium, barrier, implication, patient, person, practice, and review.

Figure 7 shows a communication technology network that is associated with the term covid, form, industry, organization, pandemic, task, work, application, office, part, project, research, resource, service, value, benefit, implementation, innovation, level, workplace, business, change, evolution, framework, influence, role, social medium, effective communication, implication, patient, person, practice, review, cost, development, effort, ICT, impact, information, number, study, and working.

According to these data, the terms communication technology are less frequently correlated with each other than technology and communication. The mapping results show that the term "communication technology" is connected to 42 terms through only 69 links. In contrast to the fields of technology and communication, which typically have a higher level of relevance and are frequently associated with a variety of terms, It is possible to conclude that research in the field of communication technology is still probably to be conducted and correlated with other terms, which will have a greater impact on the research's novelty.
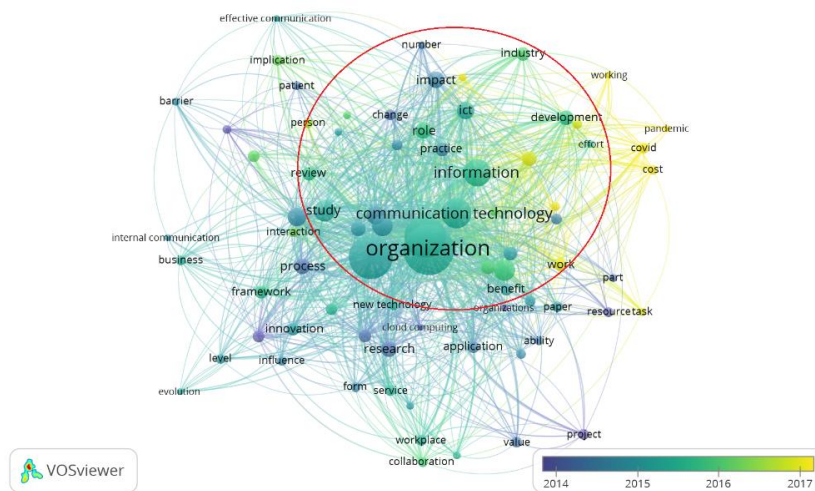


**Fig. 8. Overlay visualization of communication technology term from 2014 to 2017.**

The results of mapping the article data showed that, in comparison to the terms communication and technology, the keyword communication technology is still relatively rarely used in research. Based on the study's findings, we can discover the development of research on communication technology that is more recent and up-to-date.

## 5. Conclusions

Computational mapping analysis of research article bibliometric data was the focus of this study. This study's publication theme is communication technology. Through the use of Publish or Perish, the articles are exported from the Google Scholar database. The titles and abstracts are the library data used in this study. As many as 348 relevant articles were published between 2012 and 2021, according to the search results. The findings indicate that research on communication technology has decreased between 2012 and 2013, experienced research fluctuations between 2013 and 2019, and then decreased again between 2019 and 2021. The findings of the study demonstrate that research on communication technology continues to have a reasonable chance of being related to other terms.

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