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Misinformation in Communication Studies: A Review and Bibliometric Analysis

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Abstract

The dissemination of misinformation is a concern for political parties, news consumers and scholars of communication, and the purpose of this paper is to explore the current state, development, and important issues of misinformation research in the field of communication over the past decade. This study analysed 768 SSCI articles from the year 2014-2023 through the Web of Science database using bibliometrics. The study found that the number of published papers peaked in 2022 with 191 SSCI papers, and is considered the highest number recorded. Michael Hameleers, a scholar from the University of Amsterdam, U.S., are the largest contributor in research literature on misinformation in the field of communication at the macro, meso, and micro levels, respectively; meanwhile, "Health Communication" was the largest contributing journal. Three national level cooperation networks were seen through the cooperation network analysis, which were the United States of America, European and Asian cooperation networks; and from the institutional perspective, four basic cooperation networks were formed; whilst from the author perspective, the largest cooperation network had 22 researchers. These findings indicated that there is well-established cooperation network of authors research about misinformation in communication field. Through the citation and co-citation analysis, it was concluded that the most influential researcher in the field of communication is Emily K. Vraga. Through the cluster analysis of communication area, the misinformation studies was mainly found in the research of sharing information, governance, health, and politics. This study provides a macro framework for future researchers to examine pertinent issues of misinformation in the field of communication.

Keywords: *Misinformation, communication, bibliometric analysis, social media, research scholar.*

INTRODUCTION

With the popularity of social media, perceptions and reactions of media consumers to misinformation have become more complex. The common narrative implies that the Internet and social media, by facilitating the production and diffusion of information, have weakened the role of traditional gatekeepers and exacerbated current forms information disorder. At present, the truth does not matter to media consumers anymore as it is challenging to differentiate falsehoods from the truth, and technological advances such as deepfakes and micro-targeting have made mass persuasion easier than ever and not necessarily in positive ways (Altay & Acerbi, 2023). At the same, social media have become a major news source for people in many countries (Newman et al., 2018). Most Americans (90%) believe that social media facilitate the spread of misinformation (Knight Foundation, 2022). A 2020 poll by Pew Research Center (Shearer & Mitchell, 2021) shows that 53% of American adults often/sometimes get news from social media sites, which is more than that from radio and printed news. Through a joint statement of the National Academies and in the context of COVID-19, Marcia McNutt, president of the National Academy of Sciences of the United States said, “[...] misinformation is worse than an epidemic: It spreads at the speed of light

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throughout the globe and can prove deadly when it reinforces misplaced personal bias against all trustworthy evidence [...]" (Aïmeur et al., 2023). On average, media consumers across the world report being more worried about misinformation than about sexism, racism, terrorism, climate change, online fraud, or even online bullying (Knuutila et al., 2022; Lloyd's Register Foundation World Risk Poll, 2020; Mitchell et al., 2019). Henceforth, governments, news media organisations and academics around the world are using different means ranging from educational, legislative, to technological strategies to combat fake news to regulate the creation and dissemination of false information online, in particular on social media (Haciyakupoglu et al., 2018; The Law Library of Congress, 2019, Calvert & Vining, 2017).

This study deployed bibliometric analysis on misinformation research in the field of communication in order to ascertain. by describing it from the macro, meso, and micro dimensions. The development of misinformation research spun over the decade from 2014 to 2023, where cooperation networks, current status of research and hotspots are analysed.

LITERATURE REVIEW

The phrase "information disorder" refers to three different notions: disinformation, *misinformation*, and *malinformation*. It is difficult to pin down this new and dynamic phenomenon of informational disruption and to assess its impact on society. Bran et al. (2021) analysed 8964 papers using the Web of Science database and concluded that the number of papers, authors, and journals have increased over the period 1975-2021; research on information disorders has earned considerable attention in multiple academic fields; there are more and more works written in collaboration by scholars from different parts and cultures of the world. Pandey and Ghosh (2023) used bibliometric analysis to analyse and review the emerging literature on misinformation (2008-2022) and grouped the 10 clusters found into four major themes, namely; *1) misinformation: perception, motivation and the stimuli behind its propagation*; *2) information dissemination channels: tool for dispersing misinformation; 3) infodemic: phenomenon emerging through misinformation; and, 4) effective ways of bursting the misinformation.*

Most scholars agree that the United States has a strong relationship with misinformation research, concerning the dissemination of misinformation about health or truth manipulation. Wang et al. (2022) used bibliometric analysis to conclude that the United States is the most influential country in this field, while Ecker and Lewandowsky from the University of Western Australia published the largest volumes of papers on these topics Keywords such as "social media", "COVID-19", and "vaccination" have gained immense popularity recently. They also identified four themes that scholars are most interested in: group heterogeneity of misinformation in memory, disinformation mechanism in social media, public health related to COVID-19, and application of big data technology in the infodemic. Sweileh (2023) analysed global research trends and patterns in COVID-19 Vaccine Hypochondriasis (VH) from the period of January 2021 to December 2022. Of the 2,886 articles retrieved, one-third were from the United States. There is a relatively large number of international research collaborations in this area. The retrieved articles focused on healthcare professionals, epidemiologic studies, and misinformation. In addition to "Vaccine" and "Vaccines" journals, Lancet and BMJ journals had a leading role in the emergence of the topic. Leading global universities such as Harvard University, Johns Hopkins University, and University College London were most prolific in publishing articles on the topic. Akram et al. (2023) argues that since 2017, there has been an increase in the trend of scholarly work about truth manipulation on social media and its effects on the cognition of netizens. The United

States seem to be the most prominent node that contributed to the study of truth manipulation.

Media and information literacy appear to be essential for the development of skills among media consumers that would enable them to use information critically. The growing phenomena of misinformation and the influence of social media in particular on certain groups of people prompts us to analyse how education on media information literacy can contribute to the development of critical thinking. Lopez-Gonzalez et al. (2023) systematically reviewed published scientific literature on the intersection of critical thinking and media and information literacy, where findings from this review show that most of the scientific research results are empirical that follow three thematic patterns: scope of application; tools and assessment; and limitations and difficulties. They argue that incorporating media and information literacy into education improves critical skills. With that said, this study incorporated a bibliometric analysis of fake news literature in the field of communication studies, guided by the following research questions:

RQ1: What is the annual distribution of the amount of misinformation literature in the field of communication from 2014 to 2023?

RQ2: What are the main countries, institutions, and authors in the field of communication studies that have contributed to misinformation literature?

RQ3: How does a cooperation network develop from misinformation research in the field of communication?

RQ4: Which researchers and articles are most influential in misinformation research in the field of communication?

RQ5: What are the hotspots of misinformation literature in the field of communication?

METHODOLOGY

The bibliometric statistical method mainly includes two parts of data analysis , which are; (1) performance analysis, that is, cooperation network analysis that provides descriptive statistics on the distribution of collaboration networks by journals, disciplines, researchers, countries, etc., to grasp the research status, overall development, and collaboration in a specific research field (Ramos-Rodríguez & Ruíz-Navarro, 2004; Yan et al., 2015; Liu et al., 2020); (2) co-occurrence network analysis to describe the topics, hotspots, and future development trends in the research field according to the co-occurrence of keywords or citations. Among them, clustering, emergence, and co-citation analysis can be done based on co-occurrence analysis which helps to describe the internal relationship and structure of a specific field, and guide researchers to find the core content of the literature (Goswami & Labib, 2022; Rejeb et al., 2020). These two parts together constitute an objective summary of important issues and development trends in a field of knowledge.

With the advantages of large-scale applicability, lower costs as well as perceived objectivity, the bibliometric method and bibliometric indicators have been widely recognised and applied by governments and institutions (Haustein & Larivière, 2015). The bibliometric method helps researchers to acquire quantitative information from large amounts of data according to various bibliometric descriptors and indicators (Du et al., 2017). In addition, the use of bibliometric methods to provide research status and trends in a specific research field will help young researchers find future research directions (Jeong et al., 2014), which is beneficial for scholars who are interested in the area to quickly understand its current status and identify potential research gaps (Ye et al., 2021).

This study uses bibliometric statistics in the quantitative analysis method, collects data through the WoS database, and uses the information visualisation software Cite Space 6.2.R6 to generate different types of visual knowledge mappings for data analysis.

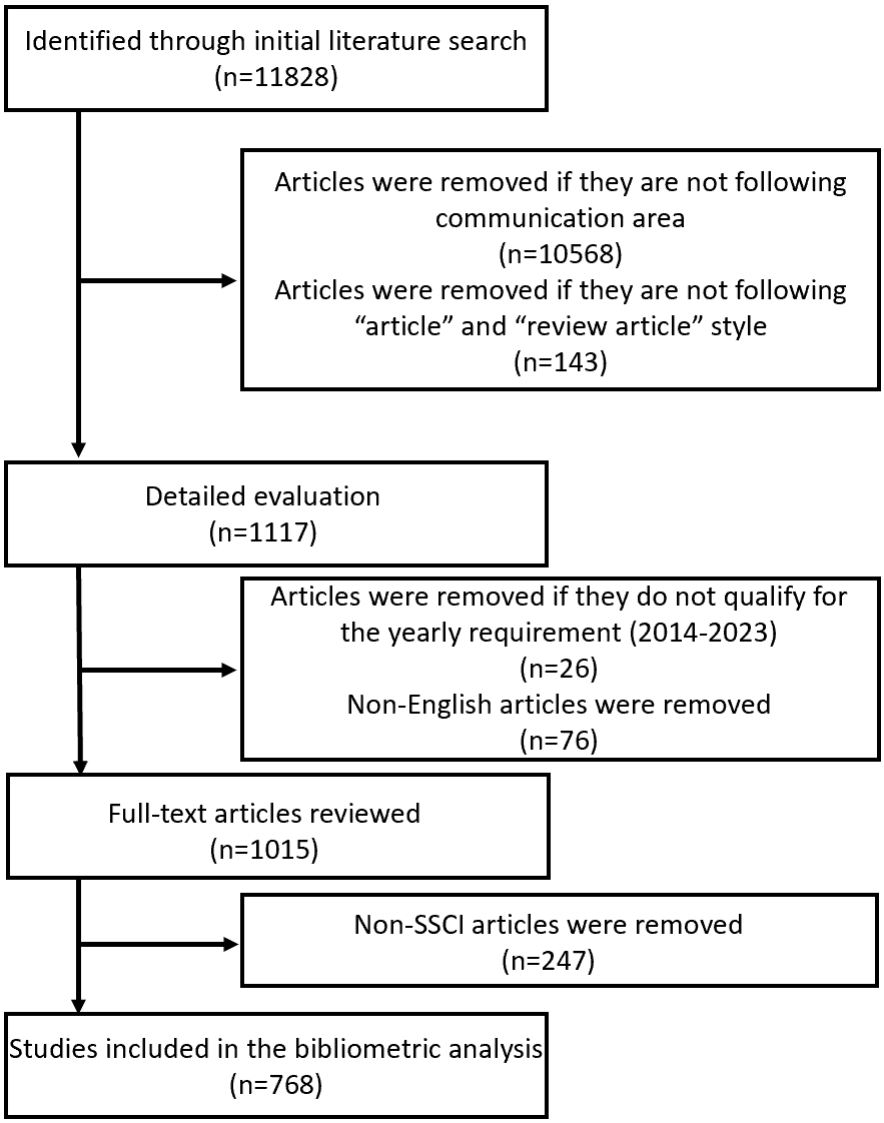

Figure 1: Diagram of the data screening process

For this study, the Web of Science database was selected for data collection, and the search strategy was to screen only articles with the topic and keyword "misinformation" (n=11828). The collection of 11828 articles included research from a wide range of disciplines; this paper aims to give researchers in the field of communication studies a comprehensive understanding of the field of misinformation research, and therefore excludes articles from non-communication disciplines (n=1260). Articles include various types such as 1075 articles, 142 early access, and 42 review articles. The current study focuses only on articles and review articles. Therefore, other types were excluded from further analysis (n=1117). This study is to examine the high-quality literature on misinformation in the field of communication in the last decade, therefore, the search results were optimized to include only SSCI articles, and the time period was chosen as 2014-2023, and finally 768 high-quality articles on misinformation

research in the field of communication were included in the bibliometric analysis of this paper. The data screening process is shown in Figure 1.

DESCRIPTIVE ANALYSIS AND RESULTS

I. Descriptive Statistics

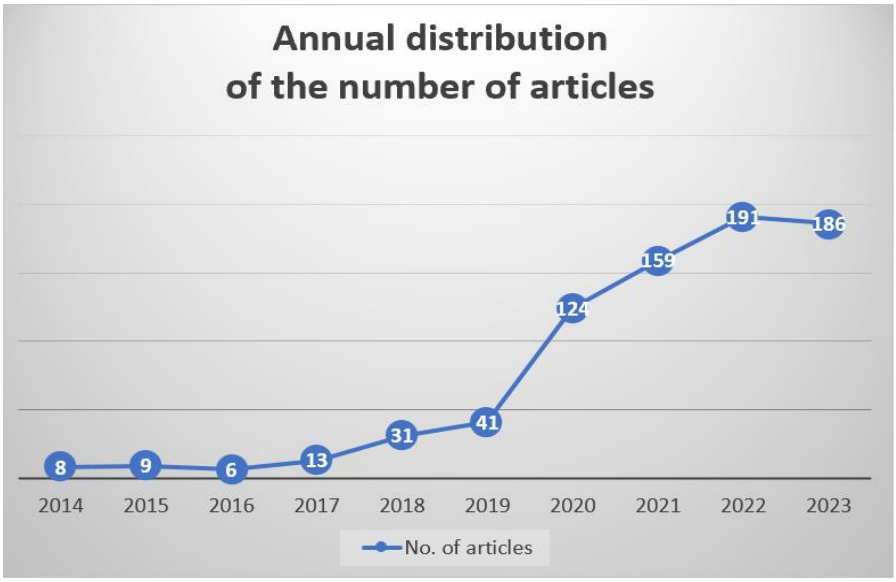

Figure 2: Annual distribution of the number of articles

To answer the first research question pertaining to the growth of fake news literature in communication, we traced the evolution of misinformation research in the field of communication. The number of articles published in a certain period reveals the development characteristics of this field to a certain extent. A total of 768 articles meeting the inclusion criteria were retrieved, and an annual distribution of the number of articles was generated. According to the Figure 2, the following analysis can be made:

i) Initial stage: The period from 2014 to 2019 - the number of papers was only between 6-41, but there has been a significant increase in the amount of literature in 2018 and 2019.
ii) Development stage: From 2020-2023 the number of published papers has increased sharply, ranging from 124 to 191. Combined with the background of current events, such as the pandemic, and the spread of online misinformation that occurred during this period are the root causes of the sudden increase in the number of articles published. This data has a strong positive correlation with background at that time.
iii) Peak period: The number of published articles reached its peak in 2022, with the number reaching 191, which is the highest record over the years. This proved that research in this field has attracted the attention of more scholars.

a) Statistics of the Contributing Authors, Institutions, Countries, and Publications

Table 1: The 12 most prolific authors contributing to misinformation research

Authors	Citation Name	Number of Publications	% of 768
Michael Hameleers	Hameleers, M.	22	2.865%
Emily K. Vraga	Vraga, E. K.	16	2.083%
Mark A. Tully	Tully, M. A.	13	1.693%
Leticia Bode	Bode, L.	12	1.563%
Nathan Walter	Walter, N.	10	1.302%
Dustin Carnahan	Carnahan, D.	9	1.172%
Andrew Chadwick	Chadwick, A.	8	1.042%
Toni G. L. A. van der Meer	van der Meer, T. G. L. A.	8	1.042%
Jiyoung Lee	Lee, J.	7	0.911%
Edson C. Tandoc Jr.	Tandoc Jr, E. C.	7	0.911%
Cristian Vaccari	Vaccari, C.	7	0.911%
Sebastián Valenzuela	Valenzuela, S.	7	0.911%

Table 1 shows the 12 most productive scholars in misinformation research as found in the WoS database and ranked according to their output. Among the 768 data included in this study, there are 12 authors with outputs greater than six. With 22 articles published, Michael Michael Hameleers is the author of the most frequently published and most widely contributed in misinformation articles in the field of communication, with 2.865% of the total data volume. Other authors with more than 10 publications are Emily K. Vraga (16 articles), Mark A. Tully (13 articles), Leticia Bode (12 articles), Nathan Walter (10 articles). In addition, Dustin Carnahan, Andrew Chadwick, Toni G. L. A. van der Meer, Jiyoung Lee, Tandoc, Edson C. Tandoc Jr., and Sebastián Valenzuela have published 7-9 articles each and have made a significant contribution.

Table 2: The 11 most prolific institutions contributing to misinformation research

Institutions	Number of Publications	% of 768
University of Amsterdam	42	5.469%
University of Wisconsin System	32	4.167%
University of Wisconsin Madison	30	3.906%
University of California System	25	3.255%
University System of Ohio	24	3.125%
University of Oxford	20	2.604%
University of Texas System	20	2.604%
Pennsylvania Commonwealth System of Higher Education Pcshe	19	2.474%
University of Minnesota System	18	2.344%
University of Minnesota Twin Cities	18	2.344%
University of Texas Austin	18	2.344%

Table 2 presents the top 11 academic institutions that have produced studies on misinformation in the field of communication. This descriptive data is from WoS, and several universities are identified as "system". The institutions with the highest number of publications and the largest contributing organisation are University of Amsterdam (42 articles), with 5.469% of the total. This data also corresponds to Table 3, where the Netherlands is the third most productive country, which is related to the contribution of the University of Amsterdam. It is worth noting that 9 of the top 11 institutions are from the U.S. They are the University of Wisconsin System (32 articles), University of Wisconsin Madison

(30 articles), University of California System (25 articles), University System of Ohio (24 articles), University of Texas System (20 articles), Pennsylvania Commonwealth System of Higher Education PCSHE (19 articles), University of Minnesota System (18 articles), University of Minnesota Twin Cities (18 articles), University of Texas Austin (18 articles). The total share of articles published by these 9 institutions is 26.563%. Combined with the data in Table 3, it shows that the United States is the highest productive country. In addition, the University of Oxford from the England has published 20 articles that contribute significantly to the study of misinformation in the field of communication.

Table 3: The 10 most prolific countries producing misinformation research

Countries	**Number of Publications**	**% of 768**
USA	409	53.255%
England	73	9.505%
Netherlands	57	7.422%
China	52	6.771%
Spain	46	5.990%
Australia	38	4.948%
Germany	33	4.297%
Singapore	30	3.906%
South Korea	25	3.255%
Canada	24	3.125%

Table 3 shows the scientific output published by country. It can be seen that the United States is the largest producers of studies in this field and the number of papers is as high as 409, accounting for 53.255% of the total data. The contribution from the United States much higher than that of other countries in misinformation studies. This is followed by England (73 articles), Netherlands (57 articles), China (52 articles) and Spain (46 articles), and others. In conclusion, the study of misinformation in the communication area has been conducted globally, albeit with a high concentration of scholarship from more progressive countries. It should be noted, when filtering the data, there were as many as 66 articles in Spanish, five articles in Portuguese, and two articles in Russian, however, only English language publications were considered in this study.

Table 4: The 11 most prolific publications producing misinformation research

Publications Title	**Number of Publications**	**% of 768**
Health Communication	67	8.724%
New Media & Society	61	7.943%
International Journal of Communication	56	7.292%
Social Media + Society	56	7.292%
Journalism Practice	37	4.818%
Digital Journalism	36	4.688%
Journal of Health Communication	36	4.688%
Science Communication	24	3.125%
Political Communication	23	2.995%
Information Communication Society	22	2.865%
Media and Communication	22	2.865%

Table 4 shows the scientific results of the publication name statistics. It can be seen that “Health Communication” is the largest contributor with 67 articles published about misinformation research, representing 8.724% of the total. Other publications with more than

50 articles are “New Media & Society” (61 articles), “International Journal of Communication” (56 articles), “Social Media + Society” (56 articles).

II. Cooperation Network Analysis and Results

Cooperation networks are represented between nodes to clearly show the cooperation between the main organizations (Liu et al., 2020). In this paper, CiteSpace software is utilized to represent the cooperation of misinformation research in the field of communication by selecting the node types as country, institution, and author in order to generate a country cooperation network map, an institution cooperation network map, and an author cooperation network map.

a) Countries

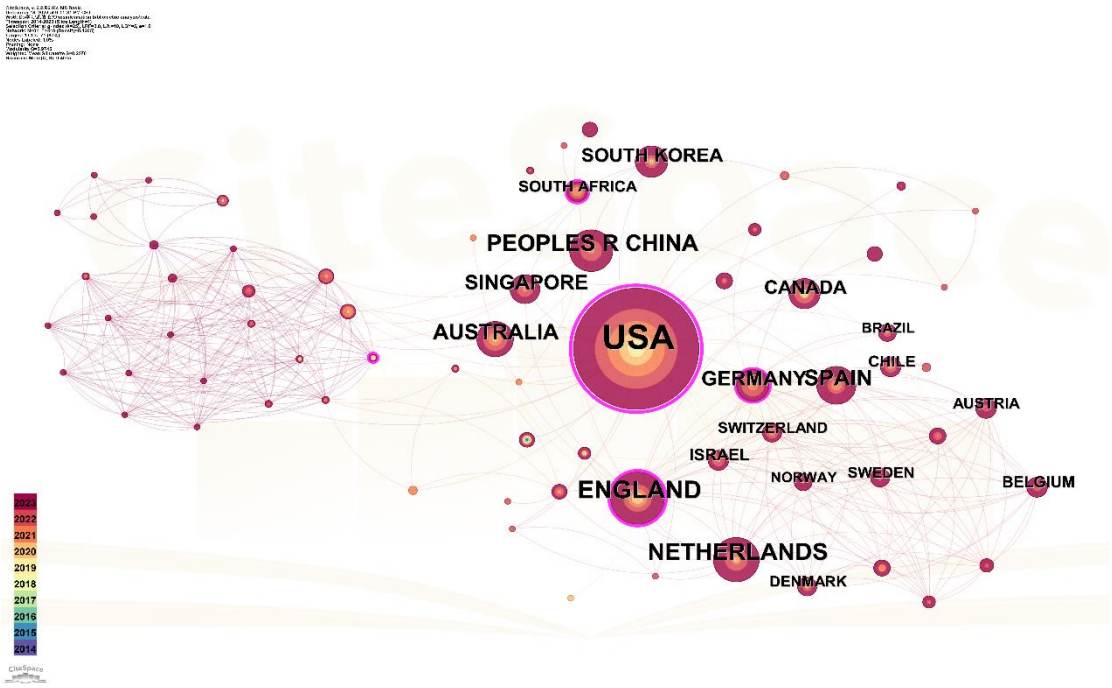

Figure 3: Knowledge mapping of countries cooperation network

With the help of Cite Space software, the visual map analysis of the 768 data selection node types is the country, and the knowledge mapping of countries cooperation networks is obtained (Figure 3). The data in the upper left corner of the figure shows that the time slice is 1 year (Slice Length=1), N=81, E=410, that represents after filtering, only the top 81 countries appeared in the Figure 3. "N" (node) represents the countries. The "E" (edge) represents the connection between the nodes. The thicker the connection, the higher the frequency of cooperation between the countries. The colours of the nodes and edges indicate the time of cooperation refer to the information in the lower left corner. Centrality is defined for each node in the network. It measures the likelihood that any shortest path in the network passes through the node. Nodes with high centrality may be located in the middle of two large clusters or sub-networks, hence the term mediator (Freeman, 1979). In CiteSpace, nodes with high centrality are shown as purple outer circle. The nodes in the purple outer circle have high centrality and strong ability to combine with other nodes.

Figure 3 also shows three distinct cooperation networks, the first one being American cooperation network: with the United States as the main country, it is surrounded by countries such as China, Singapore, South Korea, Australia, and Canada. It can be seen that in the field of misinformation research, the United States has the highest contribution, in the cooperation network, the cooperation countries are very wide, and the centrality of intermediary is also high. The second one is the European cooperation network with Spain, England, Germany, and Netherlands. as the main countries, the European cooperation network is huge and frequent. At the same time, the centrality of England and Germany is high, indicates a high capacity for combination with other countries. The third one is the Asia cooperation network: the small nodes include Malaysia, Vietnam, Laos and so on, at the same time, although the network is not mature, but Malaysia has created a high degree of centrality in this network, and by using it as a link, the Asian Cooperation Network has also created a number of cooperation with high-producing countries such as the United States and China.

b) Institutions

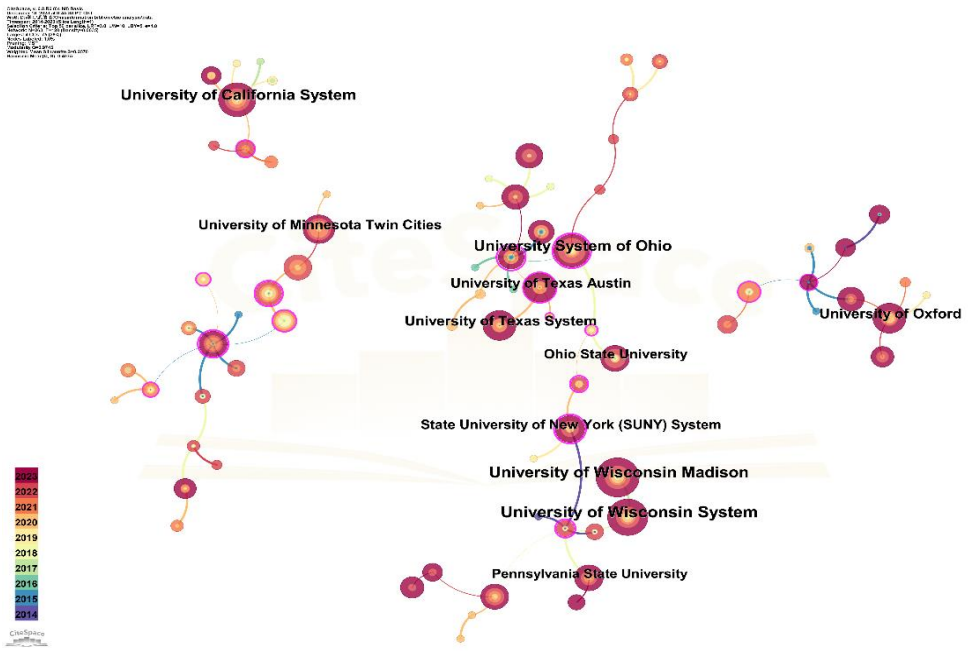

Figure 4: Knowledge mapping of institutions cooperation network

The data in the upper left corner of the figure shows that the time slice is 1 year (Slice Length=1), N=263, E=120. A total of 1,586 institutions published 768 articles, and after filtering, only the top 4 institutions cooperation networks can be shown.

Figure 4 shows 4 cooperation networks, the largest of these institutional collaboration networks is led by the University System of Ohio, University of Texas Austin, University of Texas System, Ohio State University, State University of New York (SUNY) System, University of Wisconsin System, University of Wisconsin Madison, Pennsylvania State University as the leading cooperation network of 37 institutions from the United States. The second largest cooperation network is the one led by the University of Minnesota Twin Cities that includes 18 institutions. The third cooperation network is a group of 12 institutions, mainly from the University of Oxford. The fourth cooperation network is a group of 8 institutions dominated by the University of California System.

c) Authors

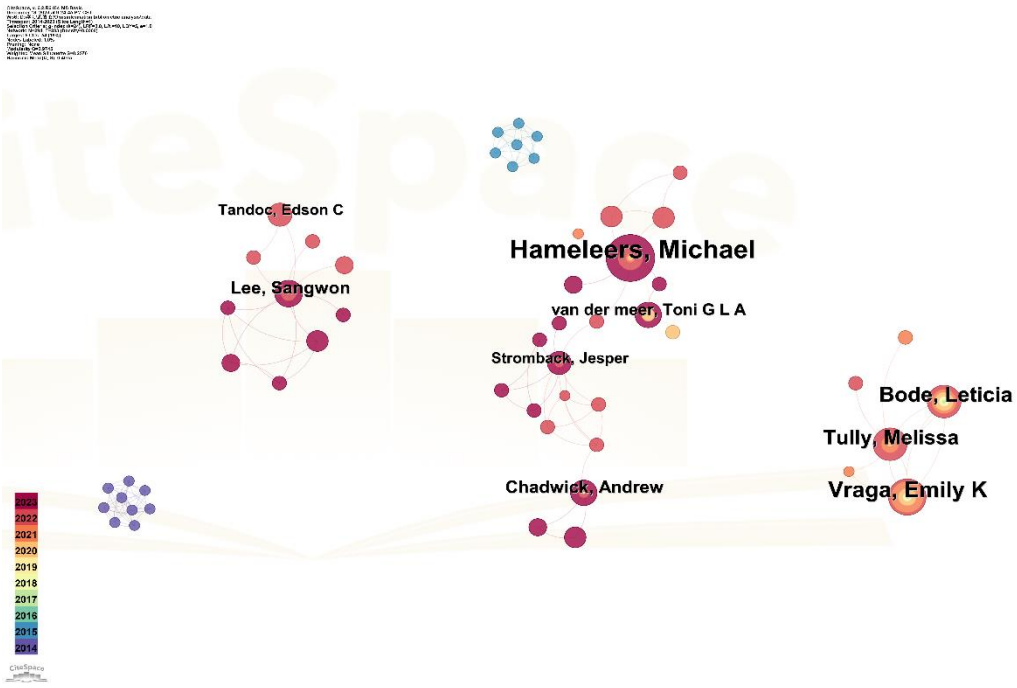

Figure 5: Knowledge Mapping of Authors Cooperation Network

The data in the upper left corner of the figure 5 shows that the time slice is 1 year (Slice Length=1), N=294, E=283. There are a total of 1791 authors in 768 articles, and after filtering, the top 5 cooperation networks are shown. The largest cooperation network has 22 researchers dominated by Michael Hameleers, Toni G. L. A. van der Meer, Jesper Strömbäck, and Andrew Chadwick, which indicates that at this stage, there is mature cooperation network of authors in the study of misinformation in the field of communication. The second cooperation network is a group of 10 researchers mainly composed of Edson C. Tandoc Jr., and Jiyoung Lee. The third cooperation network is composed of 6 researchers dominated by Emily K. Vraga, Mark A. Tully, and Leticia Bode. In contrast, the other 2 cooperation networks in Figure 5, although more numerous, are limited to cooperation on one article.

III. Citation & Co-Citation Analysis and Results

a) Citation Analysis and Results

Citation analysis is a method of tracking publishing patterns based on the assumption that a heavily cited author, paper, or book should be considered important by a large number of scholars in a discipline (Kim & McMillan, 2008). The citation index is a significant indicator reflecting the impact of a specific publication or scholar. Generally, the more citations to a publication or a scholar, the more influential the publication or scholar (Guo et al., 2019).

Table 5: Top 10 most cited articles in misinformation research

Title & Author	Year	DOI	Citations
Defining "Fake News": A Typology of Scholarly Definitions Tandoc Jr, E. C., Lim, Z. W., & Ling, R.	2018	10.1080/21670811.2017.1360143	987
Considering Emotion in COVID-19 Vaccine Communication: Addressing Vaccine Hesitancy and Fostering Vaccine Confidence Chou, W. Y. S., & Budenz, A.	2020	10.1080/10410236.2020.1838096	404
See Something, Say Something: Correction of Global Health Misinformation on Social Media Bode, L., & Vraga, E. K.	2018	10.1080/10410236.2017.1331312	378
In Related News, That was Wrong: The Correction of Misinformation Through Related Stories Functionality in Social Media Bode, L., & Vraga, E. K.	2015	10.1111/jcom.12166	326
Belief Echoes: The Persistent Effects of Corrected Misinformation Thorson, E.	2016	10.1080/10584609.2015.1102187	324
The Agenda-Setting Power of Fake News: A Big Data Analysis of the Online Media Landscape from 2014 to 2016. Vargo, C. J., Guo, L., & Amazeen, M. A.	2018	10.1177/1461444817712086	294
Emotions, Partisanship, and Misperceptions: How Anger and Anxiety Moderate the Effect of Partisan Bias on Susceptibility to Political Misinformation Weeks, B. E.	2015	10.1111/jcom.12164	296
Using Expert Sources to Correct Health Misinformation in Social Media Vraga, E. K., & Bode, L.	2017	10.1177/1075547017731776	230
How to Unring The Bell: A Meta-Analytic Approach to Correction of Misinformation Walter, N., & Murphy, S. T.	2018	10.1080/03637751.2018.1467564	205
Fact-Checking: A Meta-Analysis of What Works and for Whom Walter, N., Cohen, J., Holbert, R. L., & Morag, Y.	2020	10.1080/10584609.2019.1668894	191

Table 5 shows the 10 most highly cited articles on misinformation research in communication studies. "Defining Fake News: A Typology of Academic Definitions" is the most cited article, with 987 citations in all databases and 768 citations in the WoS database. It is also a seminal article that reviews of previous studies that have used the term fake news reveals six types of definition: *(1) news satire, (2) news parody, (3) fabrication, (4) manipulation, (5) advertising, and (6) propaganda.*

Articles with more than 300 citations also include (Bode & Vraga, 2015, 2018; Chou & Budenz, 2020; Thorson, 2016). Chou and Budenz (2020) consider the role of emotion in communication efforts. Examples include attending to negative emotions such as fear and anxiety, raising awareness of emotional manipulations by anti-vaccine disinformation efforts, and activating positive emotions such as altruism and hope as part of vaccine education endeavors in the COVID-19 pandemic period. (Bode & Vraga, 2018) recommended for social media campaigns to correct global health misinformation, including encouraging users to refute false or misleading health information, and providing them appropriate sources to accompany their refutation, are discussed. Bode and Vraga (2015) consider that the role that social media may play in correcting misinformation. Their study concluded that when related stories correct a post that includes misinformation, misperceptions are significantly reduced. Thorson (2016) talks about "belief echoes", where negative political messages continue to influence attitudes long after they have been effectively discredited. Belief echoes can be generated through automatic or deliberate processes. Belief echoes occur even when misinformation is immediately corrected, the "gold standard" of journalistic fact-checking. The existence of belief echoes raises ethical concerns about the efforts of journalists and fact-checking organizations to publicly correct misreporting.

It can be seen that in the highly cited literature, the topics are basically in the areas of health misinformation, political misinformation, and methods of correcting misinformation.

b) Co-citation Analysis and Results

Co-citation analysis, first introduced by Small (1973), has been used by many researchers to identify hot spots and to forecast future directions in scientific research. It refers to the frequency of co-occurrence, in which two papers are both cited by a third paper. The more frequently two papers are co-cited, the more likely they are to be semantically related, and thus they are more likely to belong to a similar research topic. Hence, it can be imagined that if a great number of co-citation relationships exist in a specific field of papers, a network can be constructed to describe their connections (Guo et al., 2019).

Table 6 and Table 7 summarise top 5 most influential co-cited authors and articles to misinformation research. There are clearly some overlaps between the two lists. These two tables provide consistent insights into how specific individuals and research works are shaping the field.

i. Co-citation Analysis of Authors

One of the widely used citation analyses is author co-citation analysis. It is a way to identify the intellectual structure of the knowledge domain. According to Shafique (2013), “The intellectual structure refers to the knowledge fundamental of the examined scientific domain, representing some attributes, including its disciplinary composition, influence research topics, and the patterns of its interrelationships”. It can also be utilised to trace and visualize the scholarly network of a study area (Jeong et al., 2014).

With 166 co-citations and a centrality of 0.12, Emily K. Vraga who from University of Minnesota Twin Cities is the most influential author in the field of misinformation research. Edson C. Tandoc Jr. has the second highest number of total citations for all of his articles at 164, also a significant influencer in misinformation research in the field of communication. In addition, articles of Leticia Bode, Nathan Walter, and Michael Hameleers also all have high co-citation counts, this is evidence that these scholars are influential in the field.

Table 6: Top 5 most influential co-cited authors to fake news research

Authors	Citation Name	Centrality	Number of Co-citations
Emily K. Vraga	Vraga, E. K.	0.12	166
Edson C. Tandoc Jr.	Tandoc Jr, E. C.	0.1	163
Leticia Bode	Bode, L.	0.15	158
Nathan Walter	Walter, N.	0.05	130
Michael Hameleers	Hameleers, M.	0.006	89

ii. Co-citation Analysis of Articles

Co-citation analysis is one of the most common methods used in the bibliometric analysis. When two documents are cited together in an article, it is known as a co-citation. If two documents are cited together frequently by other articles/documents, they are likely thematically similar (Leydesdorff, 1998).

Table 7: Top 5 most influential co-cited articles to fake news research

Title & Author	Centrality	DOI	Co-citations
The Spread of True and False News Online Vosoughi, S., Roy, D., & Aral, S.	0.11	10.1126/science.aap9559	119
Defining "Fake News": A Typology of Scholarly Definitions Tandoc Jr, E. C., Lim, Z. W., & Ling, R.	0.04	10.1080/21670811.2017.1360143	90
See Something, Say Something: Correction of Global Health Misinformation on Social Media Bode, L., & Vraga, E. K.	0.08	10.1080/10410236.2017.1331312	71
The Disinformation Order: Disruptive Communication and the Decline of Democratic Institutions Bennett, W. L., & Livingston, S.	0.1	10.1177/0267323118760317	65
How to Unring The Bell: A Meta-Analytic Approach to Correction of Misinformation Walter, N., & Murphy, S. T.	0.07	10.1080/03637751.2018.1467564	52

Vosoughi et al. (2018) argue that falsehood diffused significantly farther, faster, deeper, and more broadly than the truth in all categories of information, and the effects were more pronounced for false political news than for false news about terrorism, natural disasters, science, urban legends, or financial information. They said:

> We found that false news was more novel than true news, which suggests that people were more likely to share novel information. Whereas false stories inspired fear, disgust, and surprise in replies, true stories inspired anticipation, sadness, joy, and trust. Contrary to conventional wisdom, robots accelerated the spread of true and false news at the same rate, implying that false news spreads more than the truth because humans, not robots, are more likely to spread it.

The 2018 article “Defining fake news a typology of scholarly definitions” from Tandoc et al. (2018) was the highest cited document with 240 citations, indicating that the article is a seminal literature in the field of fake news research. The article identifies 6 ways in which previous research has operationalized fake news:

> A review of previous studies that have used the term fake news reveals six types of definition: (1) news satire, (2) news parody, (3) fabrication, (4) manipulation, (5) advertising, and (6) propaganda. What is common across these definitions is how fake news appropriates the look and feel of real news; from how websites look; to how articles are written; to how photos include attributions. Fake news hides under a veneer of legitimacy as it takes on some form of credibility by trying to appear like real news.

Article "The disinformation order: disruptive communication and the decline of democratic institutions" was co-cited a total of 65 times, and it also ranked high among the most highly cited articles. Bennett and Livingston (2018) said:

> Many democratic nations are experiencing increased levels of false information circulating through social media and political websites that mimic journalism formats. In many cases, this disinformation is associated with the efforts of movements and parties on the radical right to mobilize supporters against centre parties and the mainstream press that carries their messages. The spread of disinformation can be traced to growing legitimacy problems in many democracies. Declining citizen confidence in institutions undermines the credibility of official information in the news and opens publics to alternative information sources.

Walter and Murphy (2018) conducted a meta-analysis of correcting misinformation. The results suggest that correcting information has an effect on misinformation beliefs, however, correcting misinformation is more difficult than correcting health misinformation in politics, and marketing. Correcting real-world misinformation was more challenging than correcting constructed misinformation. Rebuttals are more effective than advance warnings, and appeals to consistency are superior to fact-checking and appeals to credibility.

IV. Cooccurrence Analysis & Cluster Analysis and Results

a) Keyword Co-occurrence Analysis and Results

Keyword co-occurrence analysis is a popular co-word method used at present (Chen et al., 2016). This scientific metric tool helps to generate clusters that enable a broader view of divergent research foci in a specific scientific field (Börner et al., 2000). To analyse the network, we started with the extraction of all keywords from each paper. Two keywords tend to be close if they appear in the same papers more frequently. The analysis of the keyword co-occurrence network allows researchers to reveal the core content of the literature and to describe the structure of a field (Rejeb et al., 2020).

Figure 6: Keyword co-occurrence network

By selecting the node type as keywords in the CiteSpace interface, a visual analysis of scientific knowledge mapping was conducted, resulting in the keyword co-occurrence network shown in Figure 6. The information displayed in the top left corner of Figure 6 shows "Timespan=2014-2023 (Slice Length=1)". Filtered and trimmed, N=299, E=1699, indicating 299 nodes and 1699 edges in the network. The frequency of keywords is represented by the nodes size. In Figure 6, the keywords social media, fake news, misinformation, news, information, media, communication, exposure, credibility, online, perceptions, model are displayed with larger nodes size, indicating their high frequency (more than 40) of occurrence in the 768 literature sources.

b) Cluster Analysis and Results

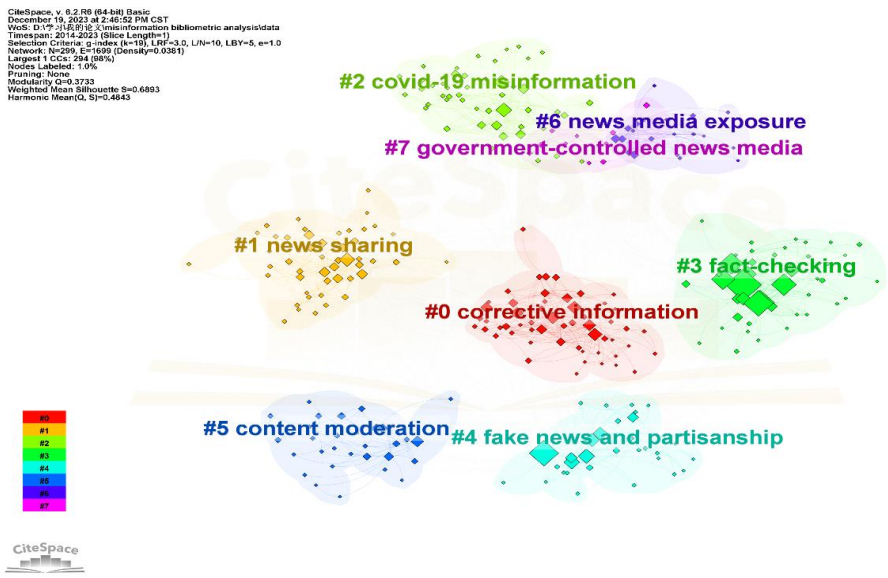

Figure 7: Cluster analysis knowledge mapping

Cluster analysis is an exploratory data analysis tool for solving classification problems. Its object is to sort cases (people, things, events, etc.) into groups, or clusters, so that the degree of association is strong between members of the same cluster and weak between members of different clusters (Yan et al., 2015). In figure 7, the 8 clusters can be mainly divided into three themes: 1) *misinformation sharing* and governance (Cluster #0, #1, #3, #5); 2) health misinformation (Cluster #2); and 3) political misinformation (Cluster #4, #6, #7).

The increasing spread of false stories or "fake news" represents one of the great challenges societies face in the 21st century. In the Cluster#1: *news sharing*, a little-understood aspect of this phenomenon and of the processing of online news in general is how sources influence whether people believe and share what they read. Bauer and Clemm Von Hohenberg (2021) believe that audiences have a higher propensity to share news by real sources. And correcting information is a common way to combat misinformation, but now a growing number of academics believe this approach has limited effectiveness. In the Cluster#0: *corrective information*, Carnahan et al. (2018) found that self-affirmation can improve the accuracy of beliefs by mitigating the impact of prior attitudes on how people respond to corrective information. This effect was particularly pronounced for those whose revisions were contrary to existing attitudes. Carnahan and Garrett (2020) found that two-sided messages, which repeat the inaccuracy before correcting it, performed better than one-sided messages among individuals using memory-based processes. These findings contribute to our understanding of fact-checking and suggest strategies that could help promote greater responsiveness to corrective messages. In the Cluster#3: *fact-checking*, scholars discuss the importance and effectiveness of fact-checking, e.g. Oeldorf-Hirsch et al. (2020) argue that fact-checking labels do not seem to have a beneficial effect on credibility perceptions of individual news posts, but their presence does seem to increase judgments of the site's quality overall. In the Cluster#5: *content moderatio*n, some countries, such as those outside Western, Educated, Industrialized, Rich, and Democratic (WEIRD) countries, have increasingly different fact-checking standards, and shifted their focus from holding politicians to account to acting as content moderators (Vinhas & Bastos, 2023). Hong et al. (2023) showed that hashtag moderation had an intended effect in reducing misinformation, and an unintended effect in reducing anger, fear, toxicity, and identity attack. Images with people of East Asian descent were associated with more anger, fear, toxicity, and identity attack than images with people of other races. Prior to content moderation, misinformation was associated with identity attack.

Health-related information and political information have been hot topics in research on the spread of misinformation. In the Cluster#2: *Covid-19 misinformation*, Yang et al. (2022) reveals interesting moderating effects for relevant channel beliefs and perceived information gathering capacity. They suggest that science communication surrounding the COVID-19 pandemic needs to attend to the target audience's beliefs about specific information channels, as well as their ability to process relevant information. Yoo (2023) argue that the negative association between COVID-19 misinformation exposure and preventive behavioural intention was weaker among individuals who were exposed to more COVID-19 news media and participated in more interpersonal communication about COVID-19.

In the Cluster#4: *fake news and partisanship*, political engagement is both a major consequence of using social media for news as well as a key antecedent of sharing misinformation (Valenzuela et al., 2019). Penney (2019) believes that youth in the Trump era have an emerging pattern on political social media, and they have changed the way they use political social media. Most scholars focus on the pervasiveness and democratic impact of

(partisan) news exposure. This focus ignores much of the online activity of most apolitical citizens. Wojcieszak et al. (2023) found that the vast majority of participants visited non-news websites. Although a small number of visits were related to politics, in absolute terms citizens were exposed to politics outside of the news more frequently than within the news. In the Cluster#6: *news media exposure*, also talked about its relationship with political misinformation. Mobile instant messaging services (MIMs) are important gateways to news exposure and political conversations. WhatsApp was rather equal across social groups, and that it could exert a significant influence on learning about politics and issues in the news as well as on protesting and other political behaviours (Valenzuela et al., 2021). Hollander (2018) believe that conspiracy theories are woven into America's social and political fabric. However, generic news media exposure offers little explanatory power, but exposure to Fox News programming predicts greater belief in theories critical of Democrats.

In contrast to the partisan misinformation found in Western democracies, there is also some concern about e.g. Cluster#7: Government-controlled news media. Like North Korea and Iran make credible news often hard to come by as these countries are notoriously hostile to foreign journalists. Journalists working for these new media prefer digital platforms to first-hand observation, arguing that digital platforms are better equipped to defend against widespread misinformation "on the ground" (Seo, 2020).

CONCLUSION

In the past decade, misinformation research in the field of communication studies was in the initial stage in the duration between 2014 and 2019, whilst in the development stage in 2020 to 2023, the number of published papers increased dramatically. The number of published articles reached a peak in 2022, reaching 191 SSCI articles, which was the highest in all the years. This proves that the research in this field has attracted the attention of more scholars.

In response to the second research question, this paper analyses the current status of misinformation research in the field of communication from the macro, meso and micro perspectives. From a macro perspective, the United States is the largest producers of research in this area, and the number of papers is as high as 409, accounting for 53.255% of the total data, The United States' contribution in this area is much higher than that of other countries. From a meso perspective, University of Amsterdam (42 articles), with 5.469% of the total, it is the largest contributing organization. From a micro perspective, with 22 articles published, Michael Hameleers is the author of the most frequently published and most widely contributed misinformation articles in the field of communication. Meanwhile, "Health Communication" is the largest contributor, with 67 articles on misinformation research published in this publication, representing 8.724% of the total.

Answering the third research question posed in this paper based on cooperation network analysis, i.e., has a cooperation network been formed in misinformation studies? From the national perspective, the first one being American cooperation network: It can be seen that the cooperation countries are very wide, and the centrality of intermediary is also high. The second one is the European cooperation network and the third one is the Asia cooperation network. From perspective of institution, four basic cooperation networks have been formed. From perspective of author, the largest cooperation network has 22 researchers dominated by Michael Hameleers, Toni G. L. A. van der Meer, Jesper Strömbäck, and Andrew Chadwick, which indicates that at this stage, there is mature cooperation network of authors in the study of misinformation in the field of communication.

Combining Tables 5, 6 and 7 to answer the fourth research th question of this study, the most influential researchers and literature in the field of communication in the direction of misinformation research are Emily K. Vraga who from University of Minnesota Twin Cities is the most influential author in the field of misinformation research. And Edson C. Tandoc Jr., Leticia Bode, Nathan Walter, and Michael Hameleers with their articles respectively.

For the fifth research question of this paper, the hotspots in the misinformation literature in the field of communication focus on the misinformation sharing and governance, health misinformation, and political misinformation.

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