Insights into Research on the Greater Mekong Subregion During the Past Two Decades: A Bibliometric Study of Scopus-Indexed Literature

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Abstract

Purpose: This study aimed to analyze research trends in the Greater Mekong Subregion over the past two decades. It focused on counting the number of articles published across different countries and journals in the Scopus database, and identifying key research areas and trends in the region between 1997 and 2022.

Methodology: The researchers analyzed 517 publications from 1997 to 2022 within the domain of science, health sciences and social sciences, using data from the Scopus database in CSV, BibTex, and RIS formats. Microsoft Excel was used for data cleaning and visualization, while VOSviewer and Biblioshiny were employed for advanced bibliometric analysis, including the creation of visualized knowledge maps to explore publication trends and research clusters.

Findings: The study revealed that most documents published on Scopus in the Greater Mekong Subregion (GMS) belong to the health sciences. Accordingly, Mahidol University was the top contributor to Greater Mekong Subregion research, with medical topics being the most published. The Bill and Melinda Gates Foundation funded 50 papers, while malaria and epidemiology dominated research between 2016 and 2022. Key terms included "plasmodium" and "public health," and the most cited work was a 2014 study on malaria resistance.

Applications of this study: This study is useful for researchers, policymakers, and institutions in the Greater Mekong Subregion to highlight important research trends and guide future funding and research efforts, particularly in areas like malaria and epidemiology. The data can also support the development of healthcare policies, strengthen public health interventions, and foster collaboration across academic and medical disciplines. In addition, bibliometric

analysis techniques are beneficial for stakeholders in analyzing future research trends across different countries, helping to establish cooperative strategies in various fields.

Keywords: Greater Mekong Subregion, Bibliometric analysis, Research trends, Biblioshiny, VOSviewer

1. Introduction

The Greater Mekong Subregion (GMS) Program aims to build a community with a promising shared future by concentrating on its core strengths of inclusivity, connectivity, and competitiveness. At the same time, the program embraces the fundamental values of environmental sustainability and resilience, internal and external integration, and resilience. The GMS nations are Cambodia, Lao People's Democratic Republic (Lao PDR), Myanmar, People's Republic of China (PRC), particularly Yunnan Province and Guangxi Zhuang Autonomous Region, Thailand, and Viet Nam. These six nations established a program of subregional economic cooperation in 1992 to foster trade ties. As noted on the page (Secretariat, 2021), The GMS Program, with funding from the Asian Development Bank (ADB) and other donors, assists in the implementation of the high-priority subregional project in the areas of agriculture, energy, the environment, health, and the growth of human resources, as well as in the industries of information and communication technology, travel, transportation, and trade facilitation. Projects involving financial investment and technical support under the GMS Program totaled $30.3 billion (Secretariat, 2021).

Not only because a subregional cooperation program concentrated on its core strengths of community, connectivity, and competitiveness but also because it embraced the fundamental concepts of environmental sustainability and resilience, took advantage of the opportunities presented by a globally interconnected economy and promoted an inclusive, equitable, and non-discriminatory business environment supported by digital economy and innovation. As evidence of this, reviews of research work on the Greater Mekong Subregion are valuable to the academic community because they contribute to advancing theories and knowledge in the examined field and inspire future research.

Bibliometrics analysis has been widely employed in many research fields in recent years, such as higher education challenges (Lambovska & Raitskaya, 2022), digital learning research (Prahani et al., 2022), creative economy and sustainability issues (Rodríguez-Insuasti et al., 2022; Abad-Segura & González-Zamar, 2021; Aver et al., 2021; Filho et al., 2020), global analysis and research trends (Morante-Carballo et al., 2022), drivers of research performance

(Lambovska & Todorova, 2021; Lambovska & Yordanov, 2020), bibliometric and scientometric review on the indexed database (Delgado & Repiso, 2013; Kozhakhmet et al., 2023; Thelwall, 2008a, 2008b; Kappi et al., 2021), i.e., Google Scholar (Aguillo, 2012; Delgado & Repiso, 2013; Delgado López-Cózar et al., 2019; Harzing & Alakangas, 2016; Martin-Martin et al., 2017; Pereira & Mugnaini, 2023), Scopus (Cantu-Ortiz, 2018; Thayyib et al., 2023), Dimensions (Orduña-Malea & Delgado-López-Cózar, 2018; Thelwall, 2018), Web of Science (de Winter et al., 2014; Kozhakhmet et al., 2023), ResearchGate (Thelwall & Kousha, 2017), and Almetrics (Amiri et al., 2023).

This study illustrates the value of bibliometric analysis by examining Scopus-indexed articles on the Greater Mekong Subregion to provide an in-depth understanding of the intellectual landscape, including key contributors and research trends. The study addresses critical knowledge gaps by identifying key contributors, thematic interests, and growth patterns in GMS research. This study sheds light on current trends and future trajectories for research in the region. This work also aims to foster collaboration by highlighting areas with potential for cross-national partnerships and policy initiatives. Ultimately, it provides a structured overview of research progress, identifies areas for strategic investment, and encourages knowledge sharing across disciplines. By applying bibliometric methods, this study offers a systematic review of GMS literature, examining its structure, performance, evolution, and future potential.

2. Research objective

This research aimed to identify the most influential contributors, research trends, key topics, and the intellectual structure of GMS-related research, and to highlight the collaborative networks, influential journals, and potential future research directions in the region.

3. Methodology

3.1 Data Sources and Search Method

We extracted the data from Scopus in February 2023. This study searched the "Greater Mekong Subregion" related keywords explored in the article title, abstract, and keyword field, and the results showed that the publications first appeared from 1997 to 2022 for all categories of published publications. The search terms and strategy of the Greater Mekong Subregion research are displayed in Figure 1. In addition, the research articles,

Review articles, Book Chapter, Conference Paper, and Book are document types. Conference Reviews, Notes, Erratum, Letters, and Editorial are excluded.
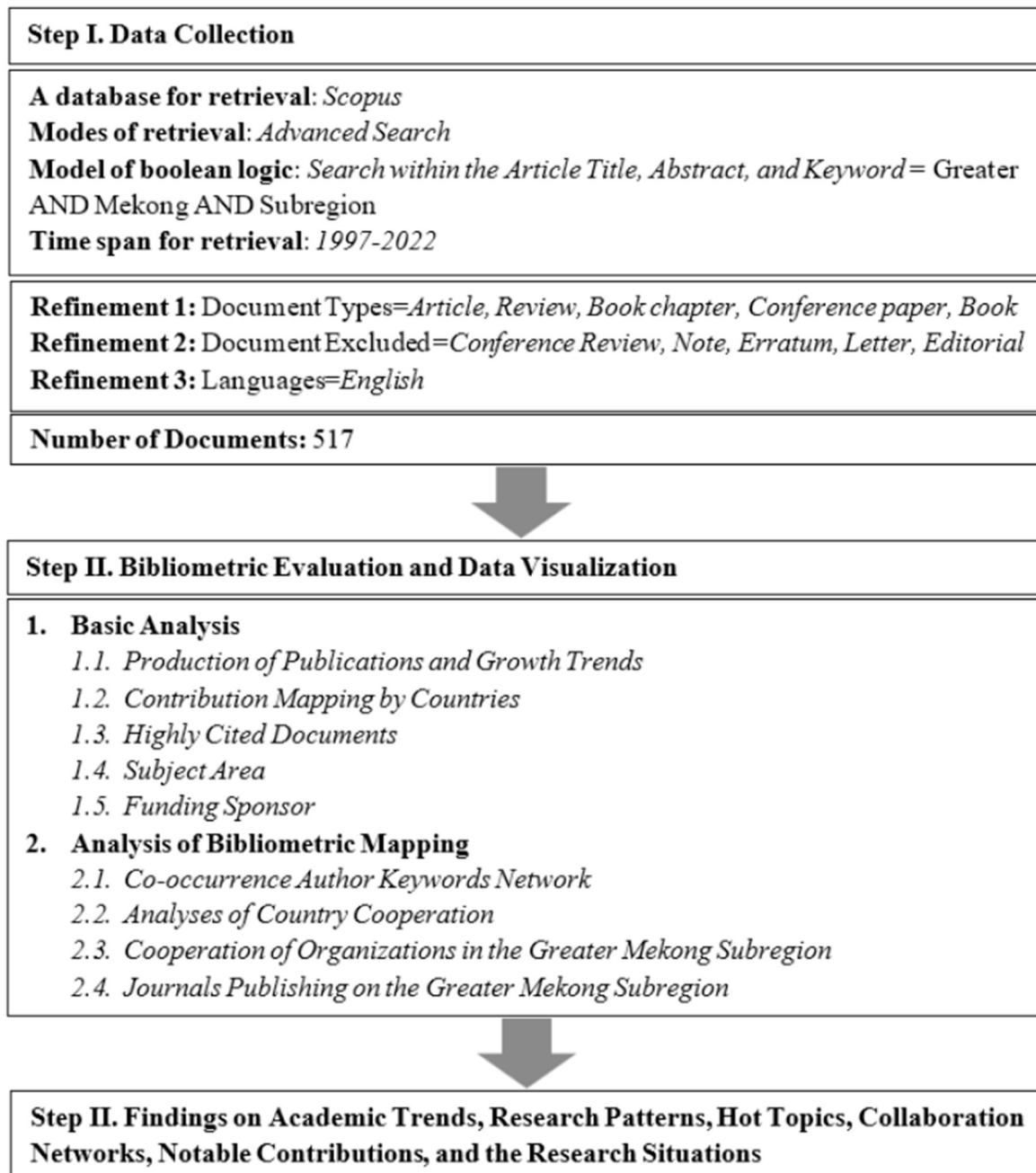
Step I. Data Collection

A database for retrieval: *Scopus*
Modes of retrieval: *Advanced Search*
Model of boolean logic: *Search within the Article Title, Abstract, and Keyword* = Greater AND Mekong AND Subregion
Time span for retrieval: *1997-2022*

Refinement 1: Document Types=*Article, Review, Book chapter, Conference paper, Book*
Refinement 2: Document Excluded=*Conference Review, Note, Erratum, Letter, Editorial*
Refinement 3: Languages=*English*

Number of Documents: 517

Step II. Bibliometric Evaluation and Data Visualization

1. **Basic Analysis**
   1.1. *Production of Publications and Growth Trends*
   1.2. *Contribution Mapping by Countries*
   1.3. *Highly Cited Documents*
   1.4. *Subject Area*
   1.5. *Funding Sponsor*
2. **Analysis of Bibliometric Mapping**
   2.1. *Co-occurrence Author Keywords Network*
   2.2. *Analyses of Country Cooperation*
   2.3. *Cooperation of Organizations in the Greater Mekong Subregion*
   2.4. *Journals Publishing on the Greater Mekong Subregion*

Step II. Findings on Academic Trends, Research Patterns, Hot Topics, Collaboration Networks, Notable Contributions, and the Research Situations

Figure 1. Stages of bibliometric analysis on Greater Mekong Subregion research.

3.2   Data Analysis

The 517 valid document results were exported in BibTex and RIS format. VOSviewer (van Eck & Waltman, 2017), a software application for building and viewing bibliometric networks, and Bibliometrix with Biblioshiny library (Aria & Cuccurullo, 2017), an

R-tool for comprehensive science mapping analysis software, were utilized to analyze the data and create graphical knowledge maps. Annual growth rate, most relevant sources, sources clustering, sources impact, author production over time, author impact, most relevant affiliations, corresponding author's country, trend topics, co-occurrence network, and authors cooperation network were examined.

3.2.1 Basic Analysis

The fundamental analysis is a descriptive technique that assesses the effectiveness and significance of a particular research area. This analysis looked at the scientific output and development of research on the Greater Mekong Subregion using fundamental indicators of publications, such as the number of documents and contributions from various nations, institutions, journals, and authors.

3.2.2 Analysis of Bibliometric Mapping

The spatial representation of the relationships between the various bibliometric analysis units is made possible by mapping analysis. The co-citation journal and co-occurrence of the author's keywords have been examined in this study. The ability to connect documents, authors, or journals based on their shared appearances in the reference list is called co-citation analysis. The title, abstract, keyword list and author-generated keyword lists are connected by co-occurrence analysis. Both analyses assess and compile a summary of the composition and development of research topics. The mapping used a threshold of 10 citations to produce ordered maps. The most frequently cited journals can be analyzed using journal co-citation, and themes related to the study area can be examined using keyword co-occurrence. Future research directions are established with the aid of this keyword co- occurrence analysis.

4.   Research results

4.1   Basic Analysis

4.1.1 Production of Publication and Growth Trends

In the Greater Mekong Subregion field, the basis analysis lists the overall number of publications each year, the total number of citations, the most successful journals, and the most often referenced works. Based on the statistics data from 1997 to 2022, there are 517 papers for all published documents. The top five popular document types were articles (390, 75%), review papers (57, 11%), book chapters (40, 8%), conference papers (22, 4%), and books (8, 2%).
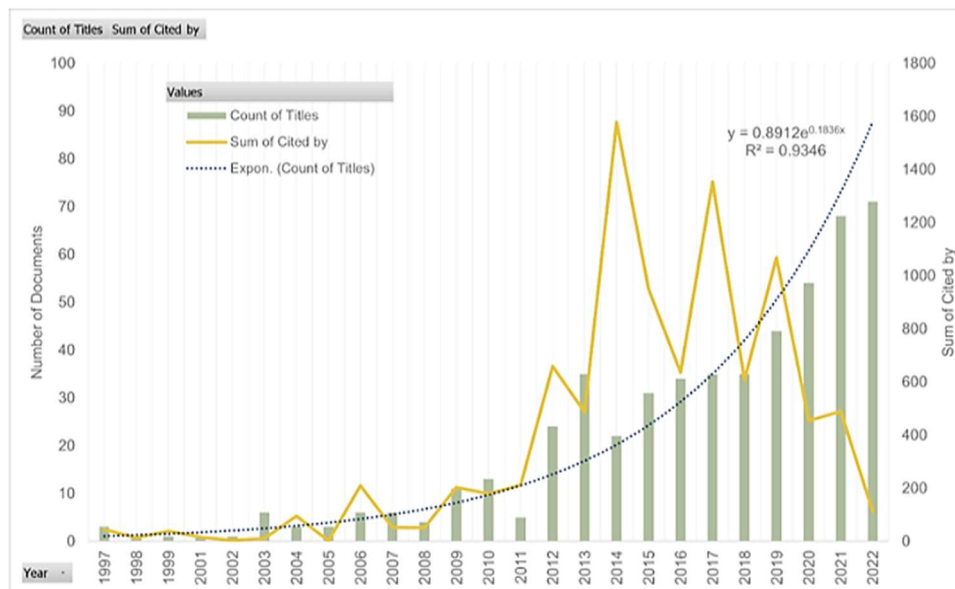
Figure 2. Annual publication output in the GMS field (analyzed by authors)

Figure 2 displays the number of publications and the number of citations in the Greater Mekong Subregion field. Before 2012, there were not many publications in the Greater Mekong Subregion. The volume of the Greater Mekong Subregion publications has been rising and fluctuating annually since 2012. Despite a significant increase in publications, the number of citations for the Greater Mekong Subregion articles in the 20 selected journals has fluctuated over the last 20 years. The number of citations peaked in 2014, indicating that publications in that year had a significant relative impact on all disciplines and had made notable contributions to enhancing the field's reputation across the board. Citations have been declining steadily since 2019 with each passing year. Because recent publications did not have enough time to be cited, this declining trend might result from the time effect.

Regression models have been tested to find the model that best fits the data to determine whether the scientific output in the Greater Mekong Subregion fits the exponential scientific growth. Given that the R^2 (coefficient of determination) value is 0.9346, the rise in production fits an exponential curve (as per the equation $y = 0.8912e^{0.1836x}$, Figure 3). A coefficient value close to one indicates that the field of study is expanding.
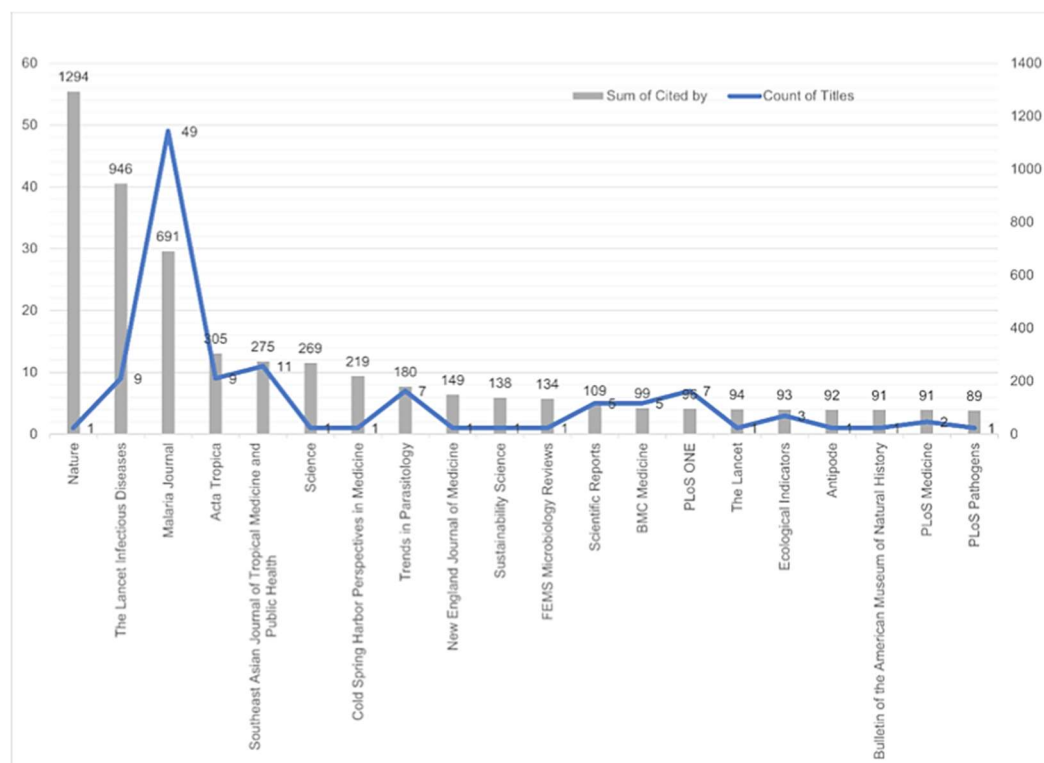
Figure 3. The number of top 20 journals with the number of citations (analyzed by authors)

The top 20 journals with the most highly cited articles are shown in Figure 3. Citations are the total number of references cited by journals in the Scopus database, and 20 carefully curated journals affiliated with Scopus journals, "Nature" (Nature, 2019), received the most citations. The "Lancet Infectious Diseases" (The Lancet Infectious Diseases Home Page, 2019) journal came next. "Malaria Journal" (Malaria Journal, 2023) and "Acta Tropica" (Aims and Scope - Acta Tropica | ScienceDirect.Com by Elsevier, n.d.) journals came in third and fourth. Fifth place went to the "Southeast Asian Journal of Tropical Medicine and Public Health." (The Southeast Asian Journal of Tropical Medicine and Public Health, 2019).

4.1.2 Distribution of Countries

Using the authors' affiliation locations, a review of scientific production by a nation can identify the nations that produce the most publications in a given field of study. The study examines 65 nations. Figure 4's map shows a color-coded breakdown of production by nation.

Figure 4. Scientific production by country distribution (analyzed by authors)

According to the findings in Figure 5, in descending order, Thailand, the United States, and China have made the most significant contributions, followed by the United Kingdom, Cambodia, Australia, Laos, Myanmar, Viet Nam, and France. The first three countries (Thailand, the United States, and China) on 13 documents collaborated to establish an evolutionary review of Malaria in the Greater Mekong Subregion as well as the challenges and prospects for malaria elimination in the Greater Mekong Subregion (Cui, Yan, Sattabongkot, Chen, et al., 2012), Malaria research for elimination, drug resistance (Cui et al., 2022; Sattabongkot et al., 2022), and human health in the Greater Mekong Subregion (Richter et al., 2015).

Thailand collaborates on 65 documents with the USA, the most-cited research being a molecular marker of artemisinin-resistant Malaria (Ariey et al., 2014). In addition, these countries investigate the evolution and expansion of multidrug-resistant Malaria in southeast Asia (Hamilton et al., 2019) and the effects of antimalaria with drug resistance in the Greater Mekong Subregion (Kobasa et al., 2018; Parker et al., 2012). Furthermore, Thailand and China studied the heterogeneity and complexity of Malaria in the Greater Mekong Subregion (Cui, Yan, Sattabongkot, Chen, et al., 2012); trends, challenges, and prospects for Malaria in the Greater Mekong Subregion (Delacollette et al., 2009); Sustainable development of the Greater Mekong Subregion (Charoenrat & Pholphirul, 2022); and collaborated with the U.K. to investigate novel approaches to control Malaria in forested areas of Southeast Asia (von Seidlein, Peto, Tripura, et al., 2019) such as in Thailand (Jongdeepaisal et al., 2022); in Lao PDR (Jongdeepaisal et al., 2022). Finally, Thailand collaborates with Viet Nam on a prospective clinical, pharmacological, and genetic study of Malaria in Southeast Asia (Hamilton et al., 2019; van der Pluijm et al., 2019)

4.1.3 Most-Cited Documents

References to publications enable evaluating and identifying relevant studies: the 517 documents and 9514 citations in the studied body of scientific literature. The top 5 documents are shown in Table 1. These sources account for 41.44% (3,943) of all citations. The studies investigate types of Malaria (Amato et al., 2017; Cui et al., 2012; van der Pluijm et al., 2019; Delacollette et al., 2009), antimalaria (Ariey et al., 2014; Imwong et al., 2017; Menard & Dondorp, 2017).

Table 1. The top 5 articles with the most citations in GMS (analyzed by authors)

Rank	Authors	Articles	Journal	Citations	Total Citations per Year
1	Ariey et al. 2014	A molecular marker of artemisinin-resistant Plasmodium falciparum malaria	Nature	1,294	129.40
2	Imwong et al., 2017	The spread of artemisinin-resistant Plasmodium falciparum in the Greater Mekong subregion: a molecular epidemiology observational study	The Lancet Infectious Diseases	284	40.57
3	Mok et al., 2015	Population transcriptomics of human malaria parasites reveals the mechanism of artemisinin resistance	Science	269	29.89
4	Amato et al., 2017	Genetic markers associated with dihydroartemisinin-piperaquine failure in Plasmodium falciparum malaria in Cambodia: a genotype-phenotype association study	The Lancet Infectious Diseases	226	32.29
5	Menard & Dondorp, 2017	Antimalarial drug resistance: a threat to malaria elimination	Cold Spring Harbor Perspectives in Medicine	219	31.29

4.1.4 Subject Area

The distribution of documents by subject area. Most papers were published in Medicine, with 25.14% (223), and the second-ranked was 15.33% (136) in social sciences. Immunology and microbiology were ranked in the top three, with 14.09% (125). In contrast, the three subject areas with the lowest number of published papers were Psychology, Materials Science, and Health Professions, accounting for each 0.11%.

4.1.5 Funding Sponsor

The number of sponsored papers differed significantly among the top five funding sponsors. Regarding this, Bill and Melinda Gates Foundation is the most highly funded sponsor, with 50 papers. The National Institute of Allergy and Infectious Diseases was second-ranked with 49 documents, followed by the National Natural Science Foundation of China (46), Wellcome trust (43), and the National Institute of Health (40). Thailand Research Fund (18), Khon Kaen University (13), Department for International Development, U.K. Government (13), Medical Research Council (12), Global Fund to Fight AIDS, Tuberculosis, and Malaria (12), and Technology, and Chinese Academy of Sciences received the least funding (12).

4.2   Analysis of Knowledge Mapping

4.2.1 Co-Occurrence of Author Keywords

The author's classification of certain words as article keywords are determined by co-occurrence analysis. This analysis's research themes and areas identify the intellectual structure of a field of study. The author keyword network was able to be created by using the VOSviewer software. 46 of the 1,219 keywords in this network have at least ten matches. Relevant topics are represented by these 46 words (nodes). A set of nodes called clusters represents the research lines or topics. The semantic map is shown in Figure 5 and has 46 nodes (author keywords) and 7 clusters (color groups).

Cluster 1 (red color), "Greater Mekong Subregion," presents 13 items with 221 occurrences, where the most frequently used terms are Thailand, Myanmar, and Cambodia. Eight items with 124 occurrences makeup Cluster 2 (green), "malaria," where the words "plasmodium vivax" and "surveillance" stand out. Out of 7 items with 50 occurrences in Cluster 3 (blue color), "plasmodium," Yunnan, and taxonomy are prominent terms. Plasmodium falciparum, integrated into Cluster 4 (yellow color), has seven items and 98 occurrences. The terms "artemisinin and artemisinin resistance" are the most important ones in this cluster. Southeast Asia and prophylaxis are the two most pertinent terms in Cluster 5

(purple color), titled "malaria elimination," and comprise five items with 44 occurrences. The terms "the Greater Mekong Subregion," "cluster 6" (light blue), "epidemiology," "public health," and "trade" stand out. There are 27 occurrences of the four items in this cluster. The primary term for the "drug resistance" cluster, Cluster 7 (orange color), which includes two items with 27 occurrences, is opisthotic viverrine.
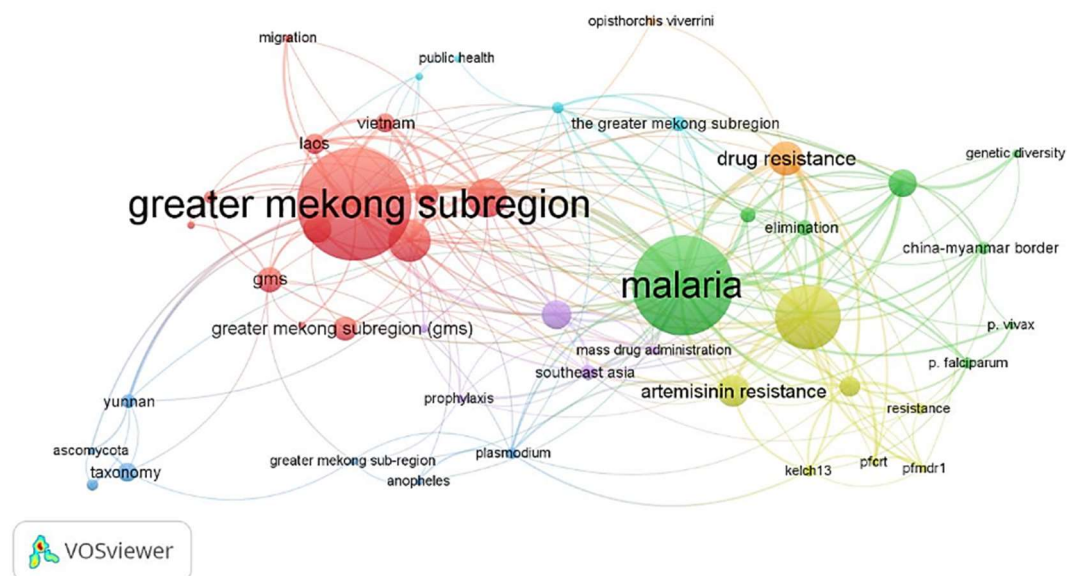

Figure 5. Network of the co-occurrences of the author's keywords (analyzed by authors). Red is represented by Cluster 1, followed by green for Cluster 2, blue for Cluster 3, yellow for Cluster 4, purple for Cluster 5, light blue for Cluster 6, and orange for Cluster 7.

A Sankey diagram (Figure 6), which enables numerous attributes to be examined under one graph, was used to depict the evolution of the several themes in this study area. This graphic was created using the Biblioshiny library and the Bibliometrix R-Tool program. Figure 9 illustrates the development of the various themes over Periods I (1997-2008), II (2009-2015), and III (2016-2022)

In the first period, the Greater Mekong Subregion (GMS) and Thailand stand out as the primary research topics. These overarching themes are divided into two categories for the second period: Thailand's relationship with the Greater Mekong Subregion (GMS) and regional cooperation. The latter was the largest area of study and included what appeared to be novel subjects like benefit sharing, Malaria, Lao PDR, Southeast Asia, and Southeast Asia. The Greater Mekong Subregion and malaria themes remain attractive in the last period.

However, a new epidemiology theme is related to Malaria, which is intensified in southeast Asia.
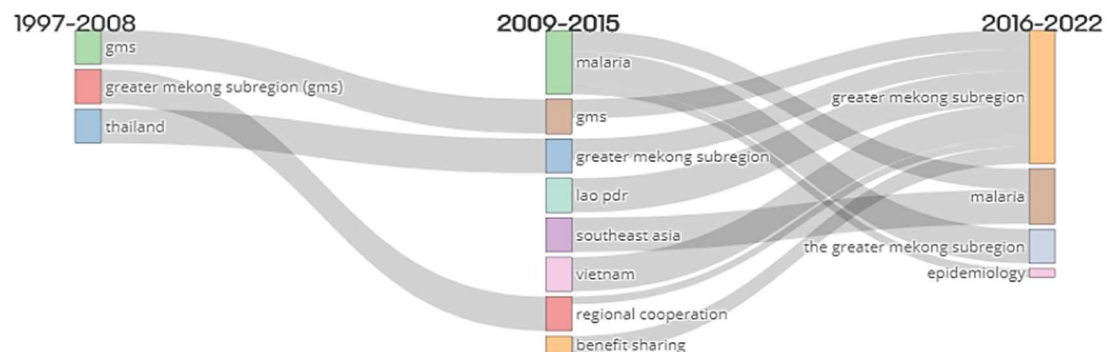

Figure 6. The Sankey diagram shows the Greater Mekong Subregion's thematic progression (analyzed by authors)

4.2.2 Analyses of Country Cooperation

1)   Co-Author Visualization Analysis of Countries.

Using VOSviewer, the countries' co-authorship network visualization map was produced (Figure 10). In mapping Figure 10, the minimum document threshold of a country was set at 10. There were 65 countries out of 28 listed that meet the threshold.

(a)   (b)
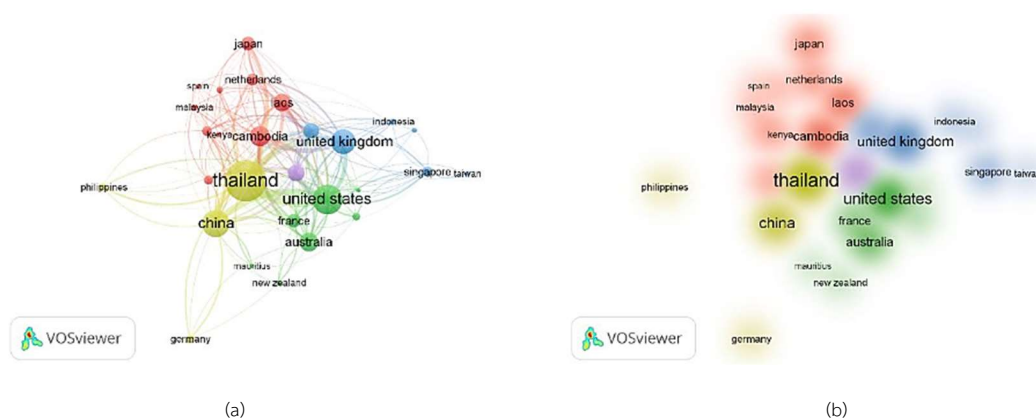
Figure 7. The following co-author country visualization maps were based on document weights: (a) network visualization and (b) density visualization (analyzed by authors)

The size of the circles in Figure 7a indicates the number of documents; the more significant the circle, the more documents. In the Greater Mekong Subregion research, five scientific clusters could be distinguished using five colors. As an illustration, Thailand (n=217), China, Germany, and the Philippines collaborated extensively, whereas the USA

(n=124), Australia, and France had close ties to the Great Mekong Subregion. The third team, represented by blue-colored nations like Singapore, Vietnam, and the United Kingdom (n=90), maintained extensive international cooperation. Figure 7b's density visualization demonstrates how the Great Mekong Subregion research was conducted with the assistance of the USA, the U.K., China, Cambodia, Myanmar, Australia, and France as the leading nations.

4.2.3 Cooperation of Organizations in the Greater Mekong Subregion

Figure 8 divided the 1696 representative organizations into four clusters, each represented by a different color. The size of each node represents the number of publications, and the line connecting the two nodes shows the academic connection between the two organizations. Stronger links result from shorter lines. As a result, Figure 8 demonstrates that the red cluster attracted the most participants (10) from organizations that researched the Greater Mekong Subregion. The faculty of Tropical Medicine at Mahidol University's department of tropical molecular Medicine and genetics took the lead in the red cluster for publication production, with the Mahidol-Oxford tropical medicine research unit coming in second. The productive institutions Mae Fah Luang University in Thailand, the University of Health Sciences in Laos, and the Mahidol-Oxford Tropical Medicine Research Unit at Mahidol University were all included in the green cluster. The blue cluster contained the critical players in the publication's production, including the Kunming Medical University's department of pathogen biology and immunology, the University of South Florida, the Myanmar Health Network Organization, and the Dalian Institute of Biotechnology.
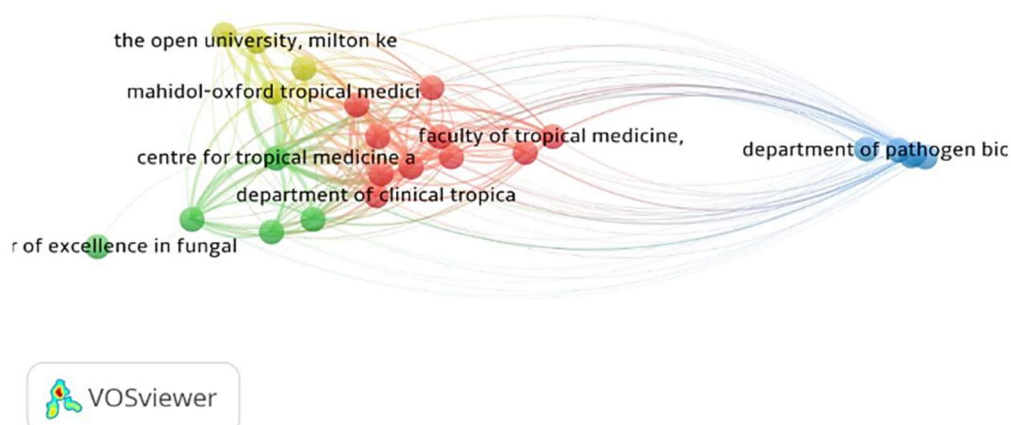

Figure 8. Based on document weights, this map shows the locations of research institutions in the Greater Mekong Subregion (analyzed by authors)

5.   Discussion

This study analyzed 517 papers from the Scopus database to examine research trends in the Greater Mekong Subregion (GMS) from 1997 to 2022. The majority of the documents (75%) were research articles, with the most productive journals being *Malaria Journal*, *Southeast Asian Journal of Tropical Medicine and Public Health*, *Antimicrobial Agents and Chemotherapy*, and *Parasites and Vectors*. Most publications were in the health sciences, particularly on malaria research.

The findings indicated that publications from the Greater Mekong Subregion have increased annually since 2012, with citation rates peaking in 2014 but declining since 2019, likely due to recent publications not yet accumulating citations.

Mahidol University led with the highest contributions (92 papers), followed by the Mahidol Oxford Tropical Medicine Research Unit and the University of Oxford. Funding came from prominent organizations like the Bill and Melinda Gates Foundation and the National Institute of Allergy and Infectious Diseases. Moreover, research results showed that Thailand, the United States, and China supported research on malaria in the Mekong Subregion. The Mekong Subregion is significant because it has historically been a hotspot for drug-resistant malaria, which poses a threat to global malaria eradication efforts. The U.S. likely supports this research to prevent the spread of drug-resistant strains, which could compromise malaria control worldwide. Additionally, collaborative research strengthens diplomatic ties and fosters regional stability, aligning with the U.S.'s strategic interests in Southeast Asia.

Additionally, the 13 collaborative documents produced by Thailand, the USA, and China emphasize malaria elimination, drug resistance, and human health, which are pressing issues in the GMS. In addition, the document distribution shows a balanced approach to malaria research: 25.14% in medicine, 15.33% in social sciences, and 14.09% in immunology and microbiology. The focus on medicine reflects efforts in treatment and drug resistance, while social sciences emphasize the importance of community engagement and healthcare access. Immunology and microbiology research aims to advance vaccine development and understand the parasite's biology. These areas support an integrated strategy, combining medical, social, and biological insights for effective malaria control and eradication.

Another finding pointed out that Thailand leads in malaria research collaboration with 217 documents, partnering most with China, Germany, and the Philippines, likely due to shared regional health challenges and expertise. The USA, Australia, and France also maintain close ties, reflecting a strong international commitment to malaria control in Southeast Asia

through shared resources, scientific knowledge, and strategic partnerships. These collaborations aim to address issues like drug resistance and cross-border transmission, supporting a united global effort toward malaria eradication. Additionally, the research focus was on malaria, with keywords such as "malaria," "plasmodium falciparum," "epidemiology," and "drug resistance" frequently appearing.

The study highlighted the importance of continued investment in research, collaboration strategies, and the need for GMS nations to support and promote research achievements. The findings also aligned with previous research and supported policies such as the Global Technical Strategy for Malaria 2016–2030 and the GMS Economic Cooperation Program Strategic Framework 2030, which emphasized health security and disease prevention in the region.

6.   Conclusion, Limitations and Future research

This study analyzed the structure, evolution, and performance of research on the Greater Mekong Subregion (GMS) using bibliometric techniques. It revealed a significant increase in scientific output, with a 93.46% rise over 26 years (1997–2022) from 65 nations, focusing primarily on malaria, antimalarial challenges, and epidemiology. The leading contributors were Thailand, the United States, China, and the Malaria Journal. The most-cited publication was *A molecular marker of artemisinin-resistant Plasmodium falciparum malaria by Frédéric Ariey (2013).*

In addition, the findings also revealed that seven key themes emerged from co-occurrence analysis of keywords, including malaria, artemisinin resistance, and public health. The 65 nations formed five research clusters, with Thailand, the United States, China, and Cambodia leading in collaboration. Cambodia showed rapid growth, indicating it as a rising hotspot for scientific research. Moreover, institutional collaboration focused on tropical medicine, biotechnology, pathogen biology, and health sciences, with stronger ties among Asian organizations compared to European ones.

However, this study's reliance on the Scopus database for data extraction between 1997 and 2022 may present several limitations. First, Scopus does not index all publications, which means some relevant research on the Greater Mekong Subregion (GMS) might be missing, especially publications in smaller regional journals or in languages other than English. This reliance could introduce a bias towards widely recognized or internationally oriented research, potentially overlooking important local studies. Additionally, the study's temporal

restriction to publications from 1997 onwards excludes earlier foundational research, which could limit a comprehensive understanding of long-term trends. Thus, the study may provide an incomplete picture of GMS research output, trends, and contributions over time.

Thus, future research on the Greater Mekong Subregion (GMS) could expand on this study by using multiple databases (e.g., Web of Science, PubMed, regional databases) to capture a broader range of publications and mitigate coverage limitations from relying solely on Scopus. Expanding the timeframe to include foundational studies before 1997 could provide valuable insights into long-term research trends and shifts in priorities within the GMS. Finally, future studies could combine bibliometric analysis with qualitative methods to better understand the practical applications of GMS research and its influence on regional policies and development strategies.

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