Jurnal Kajian Informasi & Perpustakaan Vol. 13, No. 1 (June 2025) 77-96
ISSN 2303-2677 (Print) ISSN 2540-9239 (Online)

A bibliometric analysis of information seeking patterns in a mobile environment

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Received: December 2024; Revised: May 2025; Accepted: June 2025; Published: June 2025

Abstract

The pervasive use of mobile devices has fundamentally changed the way individuals seek information, necessitating a clear understanding of evolving user behavior. This study addresses this need by conducting a bibliometric analysis of 219 documents from the Scopus database to comprehensively map the intellectual landscape and research trends in mobile information-seeking patterns. The analysis reveals significant publication growth, peaking in 2018 with 26 articles. Key contributors in this area include Lee Jongwook as the most prolific author and Kontos et al.'s (2014) work as the most influential, evidenced by its high citation count. A prominent thematic finding is the high occurrence of the term 'female' (162 times), highlighting the critical research focus on gender differences. This emphasis is significant, suggesting that gender is a crucial variable shaping mobile information interactions and search strategies. This has direct theoretical implications for refining information behavior models and practical applications for designing more inclusive and targeted mobile services. Additionally, 'quality of life' has emerged as a dominant and current research topic, indicating a shift towards understanding the broader impacts of mobile information access. Collectively, these findings offer a robust overview that can guide future research directions and inform the development of more effective, user-centric mobile information strategies.

Keywords: Information-seeking patterns; Mobile environment; User behavior; Bibliometric analysis

Analisis bibliometrik pola pencarian informasi di lingkungan seluler

Abstrak

Penggunaan perangkat seluler yang masif telah secara fundamental mengubah cara individu mencari informasi, sehingga diperlukan pemahaman yang jelas tentang perilaku pengguna yang terus berkembang. Penelitian ini menjawab kebutuhan tersebut dengan melakukan analisis bibliometrik terhadap 219 dokumen dari database Scopus untuk memetakan secara komprehensif lanskap intelektual dan tren penelitian dalam pola pencarian informasi seluler. Analisis mengungkapkan adanya pertumbuhan publikasi yang signifikan, dengan puncak pada tahun 2018 sebanyak 26 artikel. Kontributor utama di bidang ini termasuk Lee Jongwook sebagai penulis paling produktif dan karya Kontos et al. (2014) sebagai yang paling berpengaruh, dibuktikan dengan jumlah sitasi yang tinggi. Temuan tematik yang menonjol adalah kemunculan bersama istilah 'female' (perempuan) sebanyak 162 kali, yang menyoroti fokus penelitian kritis pada perbedaan gender. Penekanan ini signifikan, menunjukkan bahwa gender adalah variabel krusial yang membentuk interaksi informasi dan strategi pencarian seluler. Hal ini memiliki implikasi teoretis langsung untuk menyempurnakan model perilaku informasi dan aplikasi praktis untuk merancang layanan seluler yang lebih inklusif dan tepat sasaran. Selain itu, 'kualitas hidup' telah muncul sebagai topik penelitian dominan dan terkini, yang mengindikasikan pergeseran ke arah pemahaman dampak yang lebih luas dari akses informasi seluler. Secara kolektif, temuan-temuan ini menawarkan gambaran umum yang kuat yang dapat memandu arah penelitian di masa depan dan menginformasikan pengembangan strategi informasi seluler yang lebih efektif dan berpusat pada pengguna.

Kata Kunci: Pola pencarian informasi; Lingkungan seluler; Perilaku pengguna; Analisis bibliometrik

doi: https://doi.org/10.24198/jkip.v13i1.59751

INTRODUCTION

Mobile devices, including cell phones and tablets, are the most widely used digital technology products worldwide (Bernacki et al., 2020). Not wanting to be left behind, Indonesia has also experienced a significant digital transformation in recent years. DataReportal survey data (2024) states that in 2023, mobile connection users in Indonesia amounted to 353.8 million or 128.0% of the total population at that time, 276.4 million. Furthermore, 77.0% of the population, or 212.9 million people, are active Internet users. The more significant number of mobile connection users compared to the total population of Indonesia indicates the possibility of an individual owning more than one mobile device.

This phenomenon is good news because the increasing number of mobile device users indicates the development of better digital infrastructure. Mobile refers to goods, especially electronic goods with practical properties, to be carried anywhere. The term mobile closely relates to computing, giving rise to mobile computing—a set of tools equipped with technology as sophisticated as computers, enabling remote communication through wireless networks (Munawar, 2015). In mobile computing, interaction is built between humans (as users) and computers in a dynamic mobile environment. The purpose of mobile devices is to help complete digital tasks or activities faster, cheaper, and portable.

The mobile environment ecosystem can run smoothly due to the Internet as its support. The efficiency and effectiveness created by the mobile environment result in massive information circulation, resulting in an information explosion. It can have positive and negative impacts on the implementation of learning in the learning process because if the information source referred to is inaccurate, the learning outcomes will not be optimal (Erlianti et al., 2022). This statement also applies to other processes in fulfilling information needs. Due to the information explosion, people need clarification about information needs, information access, and information sources (Sinha, 2015).

Voorberg et al. (2021) interpret information as a collection of facts and data processed for decision-making. Humans encounter and interact with information throughout their lives. Information is an essential commodity in everyday human activities; information is needed for education, work, research, healthcare, entertainment, problem-solving, and lifelong learning (Thakuria & Chakraborty, 2021). Generally, a person seeks information based on their current needs. Information seeking indicates a need for more expertise in a particular field, such as uncertainty about a particular matter or problem (Mudawamah et al., 2023).

A person's actions in seeking information are related to information behavior. Wati et al. (2023) describe information behavior as the way a person interacts with information, including searching, using, and sharing it. The integrated mobile environment has changed user behavior, allowing users to rely on mobile devices to meet their personal, academic, and professional information needs.

Information behavior includes several human behaviors as users related to information or information systems, including creating information needs, creating the information itself, searching, finding, sharing, providing, evaluating, managing, and using the information to

design more effective information systems (Khoo, 2014). Information-seeking behavior refers to a person's deliberate actions to realize the need for information and then find and use specific information from certain resources (Rahmawati et al., 2023). Information search behavior in today's mobile environment differs significantly from manual information search behavior. Vakkari (2023) states that information searches carried out using the help of computer devices will become increasingly complex and have a broad context.

The mobile information environment impacts every stage of the information-seeking process. In Wilson's information-seeking model, for instance, the variables that determine the success of information needs fulfilment (intervening variables) include personal, intrapersonal (role-related), environmental, and information source characteristics (Meilinda et al., 2018). Regarding personal variables, the mobile environment influences information needs based on social class and profession. In environmental variables, the mobile environment affects how and when users seek information, which can now be done more effectively and efficiently through multitasking. Furthermore, regarding the characteristics of information sources, the mobile environment provides a range of formal (social media) and informal (electronic journals) information source options. Wilson also notes that barriers to information-seeking may arise simultaneously with the presence of certain conditions or contexts (Meilinda et al., 2018). In the current mobile environment context, the phenomenon of information overload is becoming a major obstacle in information retrieval.

The existence of mobile media has also assisted in spearheading the convergence of human needs (Cooper, 2023). Mobile electronic technology plays a significant role in increasing the accessibility of information anytime and anywhere. People can search for information using electronic sources by utilizing the sophistication of mobile devices connected to the Internet. Electronic sources are the best media in the information search process. Electronic sources come in many forms, such as mobile libraries, Google search engines, or social media.

Previous researchers have widely conducted research discussing information-seeking patterns. Firstly, Das & Jadab (2017) conducted a study entitled "Patterns of Information Seeking Behavior of Law Students in Digital Environment: A Study". This study focuses on information-seeking behavior patterns by law students at Dhaka University in a digital environment. The results of this study indicate that when searching for information, students tend to prefer information in electronic format over printed information. Factors that influence students in using electronic information sources are the availability of information, ease of understanding, ease of use, speed of communication, validity of information, and completeness of information coverage.

Secondly, Kumar & Shukla (2013) conducted a study entitled "Information Seeking Pattern in Electronic Environment of Science and Arts Researchers: A Comparative Study." This study focused on the comparison of information-seeking patterns between researchers from the science disciplines and researchers from the arts disciplines. This quantitative study used a questionnaire data collection technique on 193 randomly selected PhD students from both science fields at Banaras

Hindu University. The results of this study indicate that different information needs lead to different information-seeking patterns. Researchers in the science field use more electronic sources as a source of information. Meanwhile, researchers in the arts field use more printed information sources to search for information.

Thirdly, Erlianti et al. (2022) conducted a study entitled "Patterns of Information Seeking Behavior from Leckie's Perspective in the New Normal Era". This study identifying lecturers' information-seeking behavior patterns referring to the Gloria J. Leckie model to find the right model to apply to the New Normal situation at that time. The study applies a descriptive qualitative method with field and literature studies. The study results indicate that the pattern of information-seeking behavior by lecturers refers to the obligation to practice the Tri Dharma of higher education, namely education and teaching, research, and community service. Other variables that influence are the characteristics of the information needs of lecturers who utilize electronic information sources for communication activities and networking with fellow lecturers for discussion.

Many researchers have indeed conducted studies on information-seeking behavior patterns. However, researchers have not yet explored bibliometric studies that further analyze information-seeking behavior patterns in mobile environments. Therefore, based on this background, this study aimed to identify and analyze research development trends that discussed user information search behavior patterns in mobile environments.

RESEARCH METHODS

This study used a descriptive quantitative research method with bibliometric analysis. Safitri et al. (2025) stated that bibliometric analysis is research with a quantitative approach conducted to discover new perspectives on research trends from specific scientific topics by analyzing previously collected scientific publication documents. Alan Pritchard introduced bibliometrics in 1969 and defined it as applying mathematical and statistical methods to books and other communication media (Kokol et al., 2021). The bibliometric approach is related to the field of library science and information science (Anwar et al., 2025).

A well-conducted bibliometric study can promote the advancement of a scientific field and enable researchers to obtain a comprehensive overview, identify knowledge gaps, discover new ideas for research, and determine the expected contributions to the field (Donthu et al., 2021). Bibliometric research provides an effective tool for analyzing the historical development of a scientific field, structural organization, information distribution patterns, journal impact, and long-term citation trends, thereby offering a comprehensive understanding of its scientific landscape (Syakirah et al., 2025),.

This study were harvested data from the Scopus database in November 2024. Scopus was chosen because it is a high-quality database that encompasses comprehensive scientific literature from various fields of study (Amiruddin et al., 2025; Pranckutė, 2021) and provides standard metadata readable by analysis tools such as Biblioshiny. Scopus was selected also for its broad coverage in social sciences and technology, its interface that is more supportive for bulk bibliometric data extraction compared to Google Scholar, and

sometimes broader journal coverage in particular areas compared to Web of Science (WoS) for this specific topic. However, potential limitations must be acknowledged, such as language bias, as Scopus tends to index more English-language publications, and potential coverage bias, as not all global publications are indexed in a single database.

The search for research data on the topic of information-seeking behavior patterns in mobile environments in the Scopus database used three main keywords combined with the "AND" operator: "information seeking," "mobile," and "technology." These keywords directly reflect the research core scope. "Information seeking" is a standard term in information behavior studies. "Mobile" refers to the mobile device environment that is the focus. "Technology" was included to capture the broader technological context in which mobile search behavior occurs, although alternative terms such as "ICT" or "digital" were also considered. And "technology" was deemed more inclusive for the initial search phase. Researchers searched document titles, abstracts, and keywords to ensure the relevance of the results obtained.

The publication time frame was limited from 2003 to 2024. The year 2003 was chosen as the starting point because it marked the initial emergence of relevant publications at the intersection of these topics in the Scopus database, allowing for an analysis of developmental trends from the formative period to the present. This time limitation may introduce bias because it excludes very early studies that may have existed before being widely indexed or used different terminology.

The article selection process (visualized in Figure 1) followed several stages to ensure data relevance and quality. After the initial search, duplicate articles were first handled using the automatic deduplication feature available in Scopus, followed by manual checking to ensure no duplicates were missed. Subsequently, screening was performed based on inclusion and exclusion criteria. The main inclusion criterion was scientific articles relevant to the research topic. Excluded through title and abstract review were irrelevant studies, such as those that only mentioned the term superficially without a primary focus on information-seeking behavior in mobile environments or document types other than scientific articles (e.g., editorials, letters, conference proceedings without clear peer review). If there was still doubt, the researcher checked the full text. Through this screening process, 219 articles were obtained and then exported in CSV format. The CSV format option facilitates the data analysis process using the Biblioshiny and VOSviewer programs.

The primary bibliometric techniques employed in this study are performance analysis and science mapping. For performance analysis, the researcher measured several metrics, including publication-related metrics (total, single-authored publications, and productivity per active year of publications), citation-related metrics (total citations and average citations), and combined publication-citation metrics (number of cited publications). For science mapping, the researcher utilized co-authorship analysis, citation analysis, and co-word analysis. The researchers then mapped publication trends based on author, co-word and topic analysis, citations, and conceptual themes to provide a comprehensive overview of the research landscape.

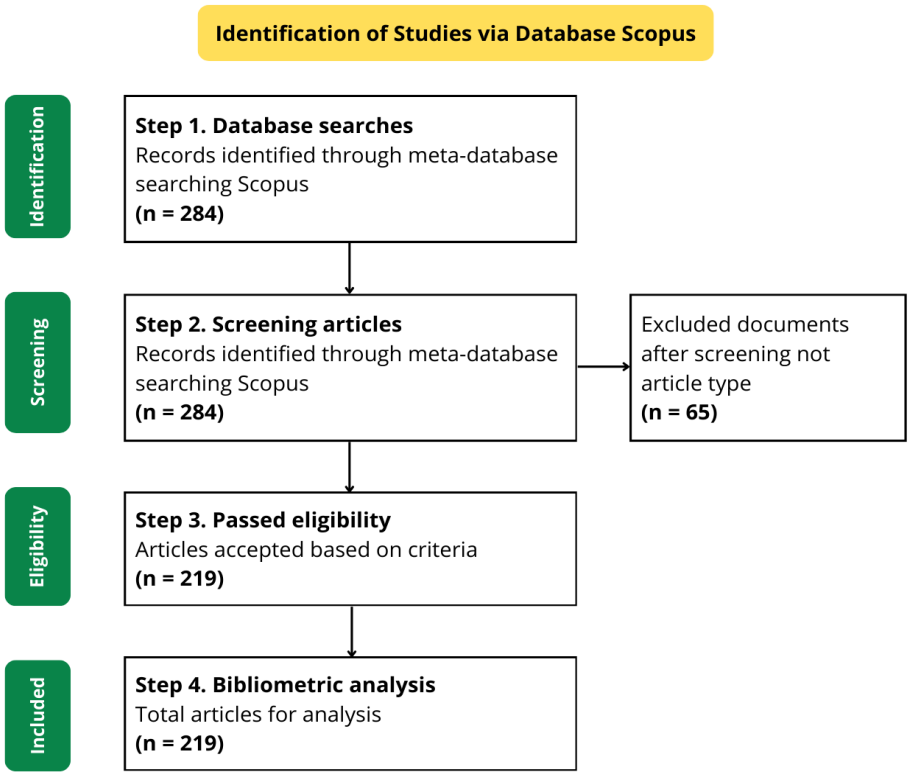

Figure 1. Article selection process
Source: Research result, 2024

RESULTS AND DISCUSSION

Publication Growth

Publications on the issue of information-seeking patterns in mobile environments have experienced significant global growth since their first appearance in the Scopus database in 2003. Although the growth of scientific article publications was very weak in the first decade, the annual growth rate of publications reached 14.11% from 2003 to November 2024. It suggests that the issue of information-seeking patterns in mobile environments has begun to attract researchers' attention as it enters the second decade. The initial slow growth followed by a surge might be attributed to the ever-evolving mobile technology landscape itself; while mobile devices have been around since the early 2000s, the widespread adoption of smartphones with sophisticated Internet capabilities and app ecosystems truly took off in the subsequent decade, creating fertile ground for research. It is evidenced by the sharp growth rate in 2014, from initially five to 15 publications, a period that coincided with the increasing global smartphone penetration and the mobile Internet infrastructure maturation.

The highest number of publications was produced in 2018, totaling 26, potentially indicating a peak in research interest or the culmination of several funded projects. Interestingly, in 2020, publication growth dropped sharply, from 24 to 11. This decline could be a temporary anomaly, possibly influenced by global events such as the COVID-19 pandemic, which may have shifted research priorities or disrupted research activities. Further analysis comparing these trends with publication rates in other fields over the same period could offer more context. Most of the articles were published in English, totaling 210 (revised from 21 for better context when the total was 219), followed by French with three articles, Spanish with two articles, and Chinese with one article.

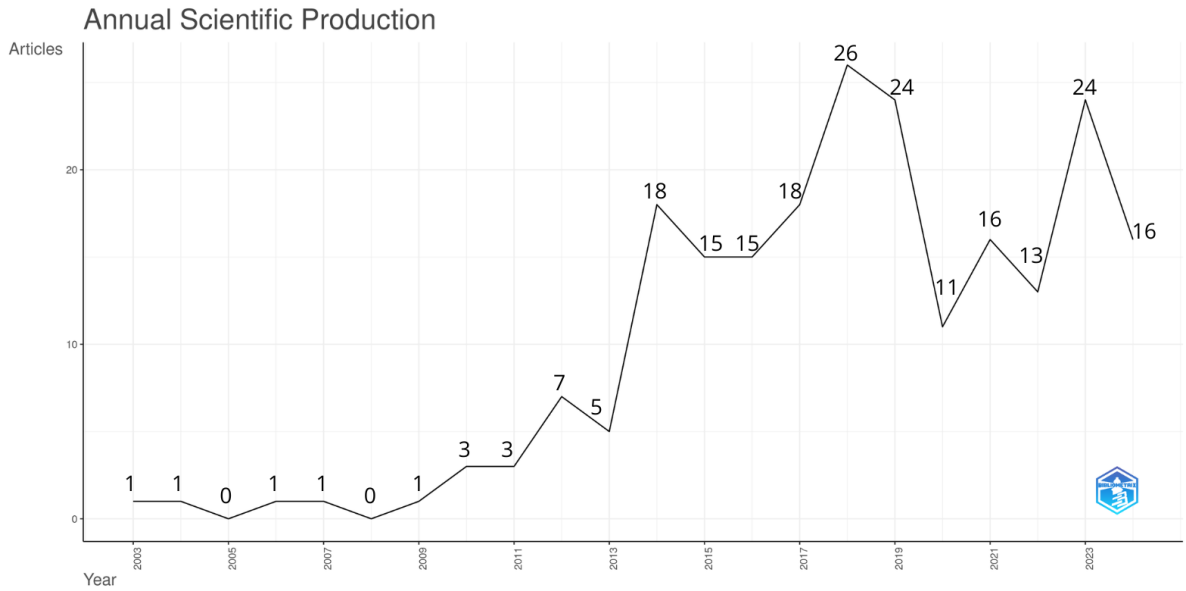

Figure 2. Production of scientific articles per year (2003-2024)
Source: Result research, 2024

As the most widely used international language in the world, English is also the language most chosen by researchers to publish their scientific work. The goal is to make these publications easily accessible and utilized by many people from various parts of the world, which also aligns with the indexing preferences of major databases such as Scopus.

The analysis results indicate that the data findings of 219 articles originate from 152 journal sources. The ten journal sources that published the most relevant articles are (1) Journal of Medical Internet Research, 18 articles; (2) Library Philosophy and Practice, six articles; (3) International Journal of Medical Informatics, five articles; (4) BMC Medical Education, four articles; (5) International Journal of Environmental Research and Public Health, four articles; (6) JMIR Human Factors, four articles; (7) JMIR Mhealth and Uhealth, four articles; (8) Journal of Health Communication, four articles; (9) JMIR Research Protocols, three articles; (10) Journal of The Medical Library Association, three articles. The prominence of journals such as the Journal of Medical Internet Research and other health-focused publications (e.g., International Journal of Medical Informatics, BMC Medical Education, JMIR series) underscores the significant relationship between mobile information seeking and health and medicine. The focus of these disciplines likely reflects the critical need for timely and easily accessible health information, for which mobile devices have become indispensable tools for consumers and professionals. The presence of Library Philosophy and Practice highlights the fundamental relevance of information science principles to this research area. This interdisciplinary collaboration suggests that knowledge will continue to grow and interconnect, enriching the understanding of mobile information-seeking behavior from multiple perspectives.

One evidence that publications on the issue of information search patterns in mobile environments are growing is their distribution across almost all continents of the world. The analysis results using Biblioshiny found that 219 published article documents came from 48 countries. Here is

the ranking of countries by number of publications: United States (301), Germany (82), England (68), Australia (54), Canada (48), China (43), Singapore (24), France (23), Saudi Arabia (22), South Korea (17), India (14), Peru (12), Ecuador (11), Italy (10), Austria (8), Ireland (8), Nigeria (7), Bangladesh (6), Brazil (6), Iran (6), Japan (6), Mexico (6), South Africa (6), Sweden (6), Tanzania (6), Turkey (6), Egypt (4), Malaysia (4), Thailand (4), Greece (3), Hungary (3), Pakistan (3), Switzerland (3), Argentina (2), Czech Republic (2), Ghana (2), Kenya (2), Kuwait (2), Norway (2), United Arab Emirates (2), Bahrain (1), Belgium (1), Denmark (1), Guam (1), Netherlands (1), New Zealand (1), Qatar (1), Spain (1), and Sri Lanka (1). The list shows that research on related topics has become quite popular among researchers, especially in the Americas and Europe.

The United States holds the first position for the country with the highest number of publications. This dominance can be attributed to several factors, including robust research funding mechanisms, advanced technological infrastructure, and a high concentration of leading research institutions.

In contrast, the observation that in Indonesia, not a single published article on research on information search patterns in mobile environments has made it into the Scopus database is noteworthy. This may indicate research gaps, potential language barriers to international publication, different national research priorities, or opportunities for future scientific development in the region. With this geographic analysis, researchers can discover new opportunities in fields or topics that are yet to be fully studied in a country. It can also encourage the development of national scientific quality for each country. Comparing these regional publication results with mobile technology adoption rates or specific socio-economic factors in these countries can yield further insights.

Author Analysis

Author analysis was conducted on 834 authors to identify authors with the largest publication output, largest H-Index impact, and co-authorship.

Table 1
List of the 10 most productive authors

Author Name	Affiliate	Article	Citation	h-index
Lee Jongwook	School of Social Work, University of Memphis	4	69	2
Mansour Essam	Department of Library and Information Science, South Valley University, Qena, Egypt	4	41	3
Escoffery Cam	Department of Behavioral Science and Health Education, Rollins School of Public Health, Emory University	3	143	2
Horvath Keith J.	Division of Epidemiology and Community Health, University of Minnesota	3	92	3
Ahmed Tanvir	Institute of Development Studies (IDS)	2	24	2
Bach Frederik	Faculty of Medicine, University of Cologne	2	6	1
Bautista John Robert	School of Information, The University of Texas	2	27	2
Blackstock Oni J	Montefiore Medical Center/Albert Einstein College of Medicine	2	30	2
Bullock Alison	Cardiff University School of Social Sciences	2	133	2
Chiu Dickson KW	School of Business and Public Administration, University of Guam, Mangilao	2	61	2

Source: Data processing result, 2024

Overall, 834 authors conducted studies on information-seeking patterns in mobile environments, of which 18 were single authors. Table 1 presents data on the list of the ten most productive authors in writing articles related to information-seeking patterns in mobile environments over 21 years (2003 - 2024). This list of the ten most productive authors will assist other researchers in finding reference sources and identifying key figures in similar research fields.

The highest number of citations is held by Escoffery Cam from the Department of Behavioral Science and Health Education, Rollins School of Public Health, Emory University, with 143 citations, and Alison Bullock from Cardiff University School of Social Sciences, with 133 citations. The number of citations by an author indicates the quality and impact of the published article. This means that previous research can drive breakthroughs in the development of science.

The authors with the most articles are Lee Jongwook from the School of Social Work at the University of Memphis and Mansour Essam from the Department of Library and Information Science at South Valley University, with four articles published. Meanwhile, the authors with the highest H-Index are Horvath KJ (3) and Mansour E. (3). The H-Index plays a significant role for researchers, serving as a benchmark for productivity and impact of published work.

The following author analysis is a co-authorship analysis. Co-authorship analysis examines the relationships among researchers in a particular field (Donthu et al., 2021). Co-authorship analysis with network visualization using VOSviewer shows the relationships among the six authors: Engelhardt, David; Bach, Frederik; Mallmann, Michael R; Schroder, Lars; Domrose, Christian M; Mallmann, Christoph A. The collaboration among researchers will encourage research advancement as it can provide greater understanding and richer insights through contributions from academics from various disciplines (Tahamtan et al., 2016). Increasing collaboration among authors on an international scale will not only expand the scope of research but also enhance the quality of research outcomes. This is because cross-country collaboration between authors allows for the exchange of new ideas and concepts, research methods, and new approaches that can enhance theoretical understanding and practical application of related research (Amiruddin et al., 2025). Future studies could explore whether co-authorship patterns differ across regions or disciplines in this particular research topic.

Co-Word and Topic Analysis

Co-word analysis is a technique that examines the actual content of the publication itself, assuming that the frequency of a word appearing together has a thematic connection with other words (Donthu et al., 2021). Counting word occurrences in the co-word analysis is based on the article's title, abstract, and keywords.

The total number of co-occurring words used by the authors in the 219 articles is 808. The ten most frequently used and discussed words are "female", "male", "adult", "human", "Internet", "humans", "information seeking", "article", "middle-aged", and "young adult". The TreeMap in Figure 3 shows more detailed information on the list of co-occurring words and their frequencies.

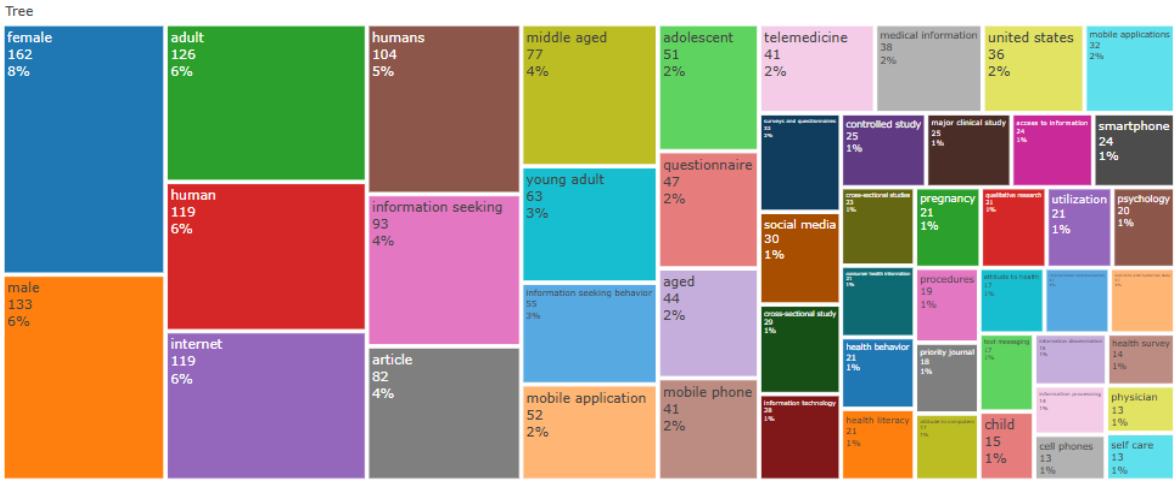

Figure 3. TreeMap of the most frequently used words
Source: Research result, 2024

The TreeMap maps the 50 most frequently used words in the 219 documents collected. The mapping results found that the word "female" ranked the highest, with 162 occurrences or 8% of the total words. Regarding information-seeking patterns, the term "information seeking" appeared 93 times together, equivalent to 4% of the total. Similarly, regarding its utilization in the mobile environment, this map shows the presence of the term "mobile application" with 52 co-occurrences, equivalent to 2% of the total word count. The prominence of demographic terms such as "female," "male," "adult," "middle-aged," and "young adult" suggests a strong research focus on how different user groups exhibit varying mobile information-seeking behaviors.

The boxes representing the frequency of word usage interpret the most important and central terms in studying information-seeking behavior patterns in the current mobile environment. To better understand the relationships between one term and another, network visualization in keyword co-occurrence analysis using VOSviewer software can be seen in Figure 4. The results of this network visualization were obtained by setting a minimum threshold parameter for the occurrence of terms at least 15 times. Thus, through this filtering, 40 main terms were obtained. Figure 4 shows the key terms related to the core focus of this study, namely information seeking. The network visualization maps the relationships between various concepts in the mobile environment area with "information seeking" at its center. The connecting lines indicate the relationships between the concepts in this term. The closer the concepts are connected, the closer they are to the center, and vice versa. Each item in the network visualization is represented by a circle whose size is determined based on the item's weight; the more significant the weight, the larger the circle size (Yalcinkaya & Yucel, 2023).

The size of the dots or circles indicates how often the keywords appear (Mühl & de Oliveira, 2022). Calculated from the interconnected lines, "information seeking" is associated with 40 words or other terms grouped into three clusters distinguished by three different colors. The terms in the first cluster (red) such as "medical information," "telemedicine," "mhealth," and "social media", reinforce the strong health orientation observed in the journal sources.

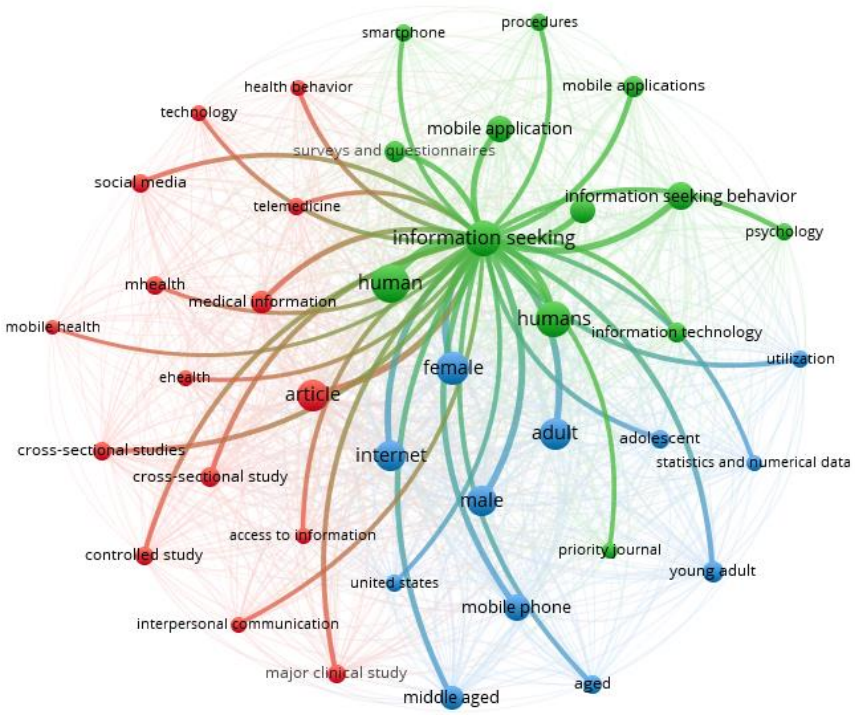

Figure 4. Network visualization of co-occurrence analysis
Source: Research result, 2024

The terms grouped in the first cluster seem to emphasize the health science discipline. The results of this mapping indicate a strong relationship concerning how the mobile environment can facilitate access to health information for the public, one of which is through optimizing the function of social media. This concept is an innovative breakthrough, particularly when applied to the public health information service system in Indonesia, which is still considered complicated and confusing by the community.

The second cluster (green) groups core concepts such as "information-seeking behavior," "smartphones," and "mobile application" with methodological terms such as "survey" and "questionnaire." The third cluster (blue) brings together demographic terms with "Internet" and "utilization," suggesting the study of usage patterns across different segments of the population.

The co-occurrence analysis results also present a visualization of the density of terms used by publications over 21 years (2003-2024) through density visualization. Some terms still rarely used in research on information-seeking behavior patterns in mobile environments include "psychology", "health behavior", "mobile health" (though mhealth is present), "access to information" (though present in cluster 1, its density might be lower), "cross-sectional study", and "interpersonal communication". These less dense areas might represent emerging research avenues or specific topics that require further exploration, particularly the psychological drivers and interpersonal dynamics of mobile information seeking. Visualization of the analysis results shows that research at the micro and macro levels, which continues to develop across all disciplines, is driving the emergence of new concepts or fields of study (Partap, 2016).

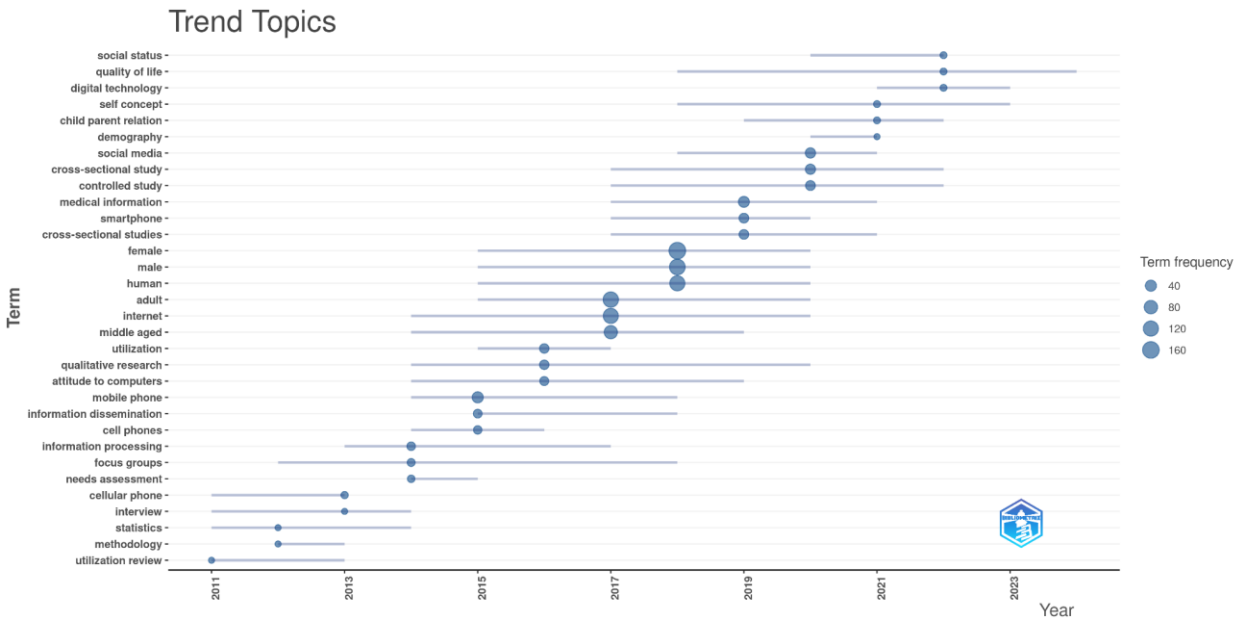

Figure 5. Research topic trends 2003-2024
Source: Research result, 2024

The Figure 5 displays the analysis of research topic trends on information-seeking behavior patterns in the mobile environment conducted with the help of Biblioshiny. It shows a graph of research topic shifts from year to year. Some topics can last a long time, such as focus groups (2012-2018), qualitative research (2014-2020), the Internet (2014-2020), and quality of life topics (2018-2024). However, some topics only have a short existence, such as: methodology (2012-2013); needs assessment (2014-2015); cell phones (2014-2016); demography (2020-2021); utilization (2015-2017); digital technology (2021-2023); and social status (2020-2022).

Researchers can identify gaps and novelties for future studies by analyzing the research topics trends above. In the past 5 years, research topics related to information-seeking patterns in mobile environments that have been studied extensively include cross-sectional studies, smartphones, medical information, controlled studies, social media, demographics, child-parent relationships, self-concept, digital technology, quality of life, and social status, with term frequencies ranging from 40 to 80 uses.

While these topics are said to be the most researched, one topic that will likely be the most popular to discuss by the end of 2024 is quality of life. The emergence and sustained dominance of "quality of life" as a research topic is particularly insightful. This trend likely reflects a societal shift towards holistic well-being and a growing recognition of how mobile technology permeates everyday life, impacting multiple aspects that contribute to an individual's perceived quality of life. Mobile devices serve as conduits for information related to health, education, social connection, entertainment, and personal development, all of which are integral to quality of life. Seeking information via mobile devices, becomes a proactive behavior for individuals aiming to enhance their well-being, manage stress, make informed decisions, or access resources that improve their living standards. This connection is crucial because it moves beyond mere information access to the purpose and impact of that

access on individuals' lives. Future research could delve deeper into the specific mobile applications or information types that most significantly correlate with perceived improvements in quality of life.

In the field of library and information science, the implications of mapping current topics in the mobile environment can be a valuable consideration for libraries and other information institutions in enhancing user services. For instance, the topic of "quality of life," which has become a growing concern in modern society, presents an opportunity for libraries to disseminate information on this subject using credible literature sources while utilizing social media as a platform for promotion. This contributes to the positive perception of libraries and information institutions as being actively involved and present in the community.

Citation Analysis

On average, other authors cited each article 26.5 times. This number of citations indicates that research on information-seeking patterns in mobile environments has become an important and interesting area for further investigation. An analysis using Biblioshiny and VOSviewer found a list of the 10 documents with the highest number of citations measured globally. The results of this analysis are shown in Table 2 (assuming these are the correct labels for the second table).

Table 2

List of the 10 most cited documents

Author	Article Title	Year	Citation	Citations per Year
Kontos, E; Blake, KD; Chou, WNS; Prestin, A	Predictors of eHealth Usage: Insights on The Digital Divide From the Health Information National Trends Survey 2012	2014	671	61.00
Wartella, E; Rideout, V; Montague, H; Ryan, LB; Lauricella, A	Teens, Health and Technology: A National Survey	2016	213	23.67
Boruff, JT; Storie, D.	Mobile Devices in Medicine: A Survey of How Medical Students, Residents, and Faculty Use Smartphones and Other Mobile Devices to Find Information	2014	204	18.55
Cho, J.	The Impact of Post-Adoption Beliefs on The Continued Use of Health Apps	2016	202	22.44
Lim, S; Xue, L; Yen, CC; Chang, L; Chan, HC; Tai, BC; Duh, HBL; Choolani, M.	A Study on Singaporean Women's Acceptance of Using Mobile Phones to Seek Health Information	2011	187	13.36
Holloway, IW; Rice, E; Gibbs, J; Winetrobe, H; Dunlap, S; Rhoades, H.	Acceptability of Smartphone Application-Based HIV Prevention Among Young Men Who Have Sex With Men	2014	182	16.55
Chan, M	Mobile Phones and The Good Life: Examining The Relationships Among Mobile Use, Social Capital and Subjective Well-Being	2015	181	18.10
Jensen, JD; King, AJ; Guntzviller, LM;	Utilization of Internet Technology by Low-Income Adults: The Role of Health Literacy, Health Numeracy, and Computer Assistance	2010	139	9.27
Kang S	Factors Influencing Intention of Mobile Application Use	2014	127	11.55
Guerra, Reyyes	Mind the Gap: Assessing the Disconnect Between Postpartum Health Information Desired and Health Information Received	2016	109	12.11

Source: Data processing result, 2024

The most cited document is an article by Kontos, E; Blake, KD; Chou, WNS, and Prestin, A. titled "Predictors of eHealth Usage: Insights on the Digital Divide from the Health Information National Trends Survey 2012," published in 2014. This study examines patients' utilization of digital media in their use of electronic health (e-Health) for healthcare and health information seeking. The high citation rate (671 citations) of this article over the ten years since its publication indicates its significant foundational importance and relevance. Its impact likely stems from addressing the critical and timely issue of the "digital divide" in eHealth usage, a topic of immense policy and practical relevance as digital health interventions expanded. The paper might have provided a robust framework, significant empirical data from a national survey (HINTS), or highlighted disparities that spurred further research and intervention. Such highly cited papers often act as cornerstones, shaping the discourse and direction of subsequent research in the area.

It is evident from Table 2 that 8 out of the 10 most published article titles discuss issues in the health sector. It is influenced by society's high awareness of healthy living, which creates an urgent need for information that must be met. The significance of these health-related papers gaining high citations lies in their direct applicability and the pressing nature of health concerns. Mobile technology offers a powerful platform for health information dissemination, patient education, and remote care, so research in this area is highly impactful. These influential papers likely offered novel insights into user adoption of health apps (e.g., Cho (2016), Kang (2014), explored specific health contexts like HIV prevention (Holloway et al., 2014), or examined information-seeking in specific demographics such as adolescents (Wartella et al., 2016) or women (Lim et al., 2011), thereby providing valuable evidence for a broad range of stakeholders. Fulfillment of information needs is crucial to support the smooth running of daily activities (Fitria & Prajawinanti, 2022). Thus, the presence of mobile technology will significantly assist in information retrieval. A more in-depth analysis could involve examining the methodology or specific theoretical contributions of these highly cited papers to understand what made them particularly seminal. Comparing their findings with less cited contemporary papers on similar topics might also reveal factors contributing to research impact.

Citation analysis was also conducted on countries that produced related publications. The results of the analysis using the Biblioshiny software show a list of countries with the highest number of citations from 2003 to 2024. These countries are the United States, with a total of 2,622 citations and an average of 41.60 citations per year; the United Kingdom with a total of 469 citations and an average of 33.50 citations per year; Canada with a total of 224 citations and an average of 18.70 citations per year; Singapore with a total of 223 citations and an average of 37.20 citations per year; South Korea with a total of 217 citations and an average of 43.40 citations per year; Australia with a total of 194 citations and an average of 24.20 citations per year; China with a total of 173 citations and an average of 19.20 citations per year; Germany with a total of 150 citations and an average of 11.50 citations per year; and Hong Kong with a total of 93 citations and an average of 23.20 citations per year.

The United States, which holds not only the top position as the country with the highest publication production rate but also the highest number of citations, demonstrates strong support within its academic community for knowledge development through research and study and potentially greater global visibility or influence of its research output. The high average citations per year for countries such as South Korea and Singapore are also notable, suggesting impactful research contributions relative to their total output.

Concept Mapping

Biblioshiny software was used to analyze thematic concept mapping related to information-seeking patterns in the mobile environment. Figure 6 categorizes various publications-related themes based on their development and levels of relevance. Quadrant I, located at the top right, represents the motor theme category that is developing and has a high level of relevance. The themes human, humans and information seeking are at the peak of the quadrant, meaning these three themes are experiencing rapid development and have high relevance, forming the core conceptual backbone of the research area. The following themes are the themes of mobile phones, priority journals, and access to information, which are developing and have a level of relevance below the previous three themes, indicating key enabling factors and dissemination channels. Not only that, the themes of pregnancy, child, and health care delivery also fall into quadrant 1 with a reasonably balanced position between development and relevance, highlighting specific, highly active application domains.

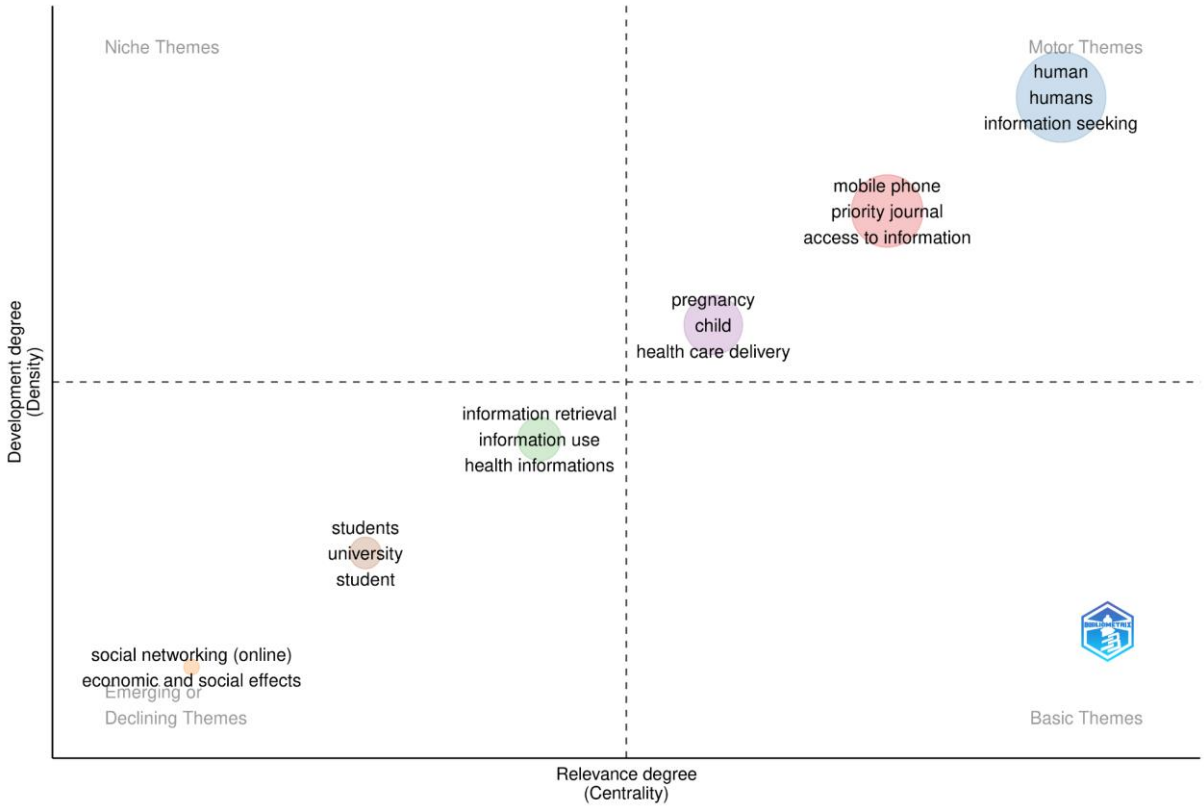

Figure 6. Thematic concept mapping
Source: Research result, 2024

Quadrant II, located in the lower right corner, is a category of declining but still relevant fundamental themes. These basic themes contain important topics that are fundamental, general, and cross-cutting in the field of research but have yet to be well developed (Cobo et al., 2015). However, in this study, the analysis results graph did not show any themes that fall into quadrant 2. This could suggest that the fundamental concepts are either still actively developing (motor themes) or have become more specialized.

Quadrant III, located in the lower left corner, represents emerging or declining themes, which are themes that are declining in development and relevance or emerging with currently low centrality. The themes of (online) social networking and economic and social effects are positioned at the bottom of this quadrant, perhaps indicating that while present, they are not very central or are evolving into more specific niche areas. Then, in the middle position are the themes of students, universities, and college students. The themes of information retrieval, information use, and health information are located in positions approaching centrality. These themes highlight the increasing importance of the information retrieval process, its use, and health-related information, suggesting that they are well-established but perhaps less dynamic than motor themes.

Finally, quadrant IV, located in the upper left corner, represents the niche themes category, which includes emerging themes that are less relevant or highly specialized themes with good development but low current centrality. This study did not show themes included in this niche themes category. The absence of themes in Quadrants II and IV might indicate a field that is still consolidating its core (motor themes are very strong) or that its specialized/declining areas are not numerous enough to form distinct groups in this particular mapping. Comparing this conceptual structure with those from related fields (e.g., general Internet information-seeking or health informatics) could provide insights into the unique thematic evolution of mobile information-seeking research.

CONCLUSION

Bibliometric analysis is important for researchers or academics before conducting research and helps researchers discover new topics in their field. This analysis presents various topics that previous researchers may have yet to cover. In examining information-seeking behavior patterns and their relation to the mobile environment, this topic has experienced significant development. However, initially this topic was stuck in the same position for the first few years of related publications appearing in the Scopus database. The search process using the keywords "information seeking," "mobile," and "technology" with filters applied for article-type documents resulted in a total of 219. The highest number of article publications in the Scopus database was produced in 2018, comprising 26 publications. Author Lee Jongwook from the School of Social Work, University of Memphis, has the highest publication productivity, with four articles. Out of 808 shared words, the most frequently used word by researchers in their published articles is "female." Meanwhile, the term "information seeking" is used 93 times. Co-occurrence analysis using VOSviewer shows a network of words with "information seeking" at its centre. As a result, "information seeking" is related to 40 terms from various fields of study. The topic analysis found that the most popular topic

until 2024 is quality of life. The most cited document during the publication period is Kontos et al.'s (2014) paper entitled "Predictors of eHealth Usage: Insights on the Digital Divide from the Health Information National Trends Survey 2012," which has been cited 671 times. The United States occupies a leading position in two aspects of the analysis: the country with the highest publication production rate and the highest number of citations. Analysis is also conducted using thematic concept mapping to understand the development and relevance of related research themes. The themes that are developing rapidly and have a high level of relevance are human, humans, and information seeking. This thematic concept analysis will greatly assist researchers in identifying research themes that are categorized specifically as currently developing, fundamental, declining, or have become less relevant.

Currently, the bibliometric analysis study on user information-seeking behavior patterns in mobile environments that the researchers are examining still has limitations, such as researchers only analyzing data on a few aspects and not in detail and comprehensively. Further research will be better if the analysis is conducted comprehensively and in detail on other aspects and the data obtained.

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