A bibliometric analysis of multi-homing in multi-sided platforms and markets: Trends, influences, and research topics

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Abstract. This research quantitatively analyzes studies on multi-homing within multi-sided platforms and markets. The study identifies trends in annual publications and citations, highlights the most productive sources and influential papers, and outlines key research topics that have contributed to this field in the past and present. The literature search had no restrictions on research subjects, allowing for a broad scope of analysis. Using bibliometric analysis, the study evaluated 253 articles published in the Scopus database from 2000 to mid-2024. The number of research publications during this period shows increasing trend. The key research topics identified include (a) network and telecommunications technology, (b) information systems and platform ecosystems, (c) the network effects on platform competition, (d) network externalities and their implications, and (e) economic competition and platform governance. The results of this research may enhance understanding and provide valuable insights for practitioners and researchers for future studies on competition among multi-sided platforms and markets, particularly in the context of multi-homing.

1 Introduction

The increasing number of businesses facilitated by platforms highlights platforms' significant role in the modern economy. The term 'platform' is taken from engineering, referring to technological standards that enable interoperability and interconnection between various components such as computers, software, and electrical equipment. Markets and platforms both represent similar economic phenomena. A market is a physical place where people or businesses meet to buy and sell goods or services. Platforms, on the other hand, refer to a more modern concept where transactions occur digitally. These platforms are virtual spaces on the internet that facilitate interactions between economic actors using information and communication technology (ICT), such as online stores, mobile applications, and digital financial apps. ICT is used to connect buyers and sellers without the need for physical meetings. Interestingly, markets and platforms can also be hybrids of physical and virtual locations [1], [2].

Two-sided or multi-sided markets form the basis for multi-sided platform research. Rysman [3] describes a two-sided market as a market in which (1) two groups of agents interact through an intermediary or platform and (2) the decisions of each group of agents affect the outcomes for the other group, typically through externalities. In other words, the value or utility of a product or service increases as the number of users increases. Platforms are often associated with 'network effects,' where the more users adopt a platform, the more valuable the platform becomes for both owners and users due to increased access to the user network [4]. Additionally, there is an essential phenomenon of network externalities, which refers to the value, utility, or impact experienced by users due to changes in the number of other users. Network externalities can be classified into two main types: direct and indirect externalities, depending on the source of benefits received by participants in the network, not necessarily on the magnitude of the network effect [5], [6], [7].

Multi-homing refers to a user's decision to use or access multiple platforms simultaneously within a network. The opposite of multi-homing is single-homing, where users use only one platform to request a service [8]. Initially, multi-homing was an internet term used to describe a host with more than one connection to the Internet. For example, multi-homing involves techniques for connecting a host to the Internet through two or more Internet Service Providers (ISPs) to maintain network connectivity even if one connection fails. Multi-homing has been analyzed in this context by Cremer et al. [9], [10].

Multi-homing plays a crucial role in competitive dynamics, with broad and significant effects impacting various technical, economic, and strategic aspects. In economics, multi-homing can reduce the market power of specific platforms because users are not exclusively tied to one platform. This situation encourages platforms to continuously innovate, improve services, and offer additional incentives to attract and retain users—additionally, multi-homing highlights switching costs and barriers as critical factors influencing user behavior. In Engineering or Computer Science, multi-homing enhances system reliability and performance. Multi-homing makes systems more resilient to failures or

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disruptions by utilizing multiple network connections or platforms simultaneously. This approach ensures service continuity and can optimize overall performance.

Several studies have discussed literature reviews and bibliometric analysis related to multi-sided platforms. Liu et al. [11] conducted a bibliometric analysis of 30 years of platform research. Their study is limited to business, economics, and management journal papers. Liu et al. [11] identified research themes by clustering based on co-citation and time zone analyses. Sanchez-Cartas and Leon [12] surveyed the theoretical literature on multi-sided platforms, explicitly focusing on pricing, coordination problems, and ownership structure research. Multi-homing is one of the essential topics that must be considered in these aspects. Qureshi et al. [13] performed a bibliometric analysis and literature review of Digital Multi-Sided Platforms (DMSP). Their clustering results indicate that one of the current research trends is studies on network effects. Discussions on network effects and network externalities are closely related to multi-homing issues. Rietveld and Schilling [14] conducted a systematic and interdisciplinary review of platform competition, focusing on papers published in management and organization, information systems, economics, and marketing. Multi-homing is included in the third theme of the four discussed, which relates to heterogeneity effects within platform categories, complementors, and users. Vlašić and F. Živković [15] addressed a literature review on the implications of multi-homing for multi-sided platforms. Given the variety of industries covered in the literature, Vlašić and F. Živković [15] focus more on the taxi service industry by providing a brief overview of market dynamics for each market side.

As the digital economy continues to evolve, understanding the dynamics of multi-homing becomes essential for both researchers and practitioners. Multi-homing influences platform competition, user retention, and the broader network effects that shape platform growth. Although the volume of literature on this topic has increased, a comprehensive analysis of research trends, influential studies, and key thematic developments is still lacking. This paper aims to address these gaps by providing an interdisciplinary bibliometric analysis of the trends and developments in multi-homing research within the context of multi-sided platforms and markets. The research questions (RQs) for this study are:

RQ1: What are the annual publication trends, top production sources, and influential papers related to the phenomenon of multi-homing in the context of platforms and markets?

RQ2: What are the primary and trending topics on multi-homing in multi-sided platform studies related to the phenomenon of multi-homing in the context of platforms and markets?

The analysis is based on a comprehensive search of the Scopus database as the primary data source. The study does not restrict the subject area when selecting publication documents, allowing for a broad scope of analysis that includes all relevant research on multi-homing. The findings of this research are expected to contribute to a deeper quantitative understanding of the trends and developments in publications on the phenomenon of multi-homing in multi-sided platforms and markets and to provide a foundation for further research on this phenomenon.

2 Method

To ensure that this research is based on strong and relevant evidence, a systematic data pre-processing approach was followed. Figure 1 shows the flow diagram for obtaining eligible studies.

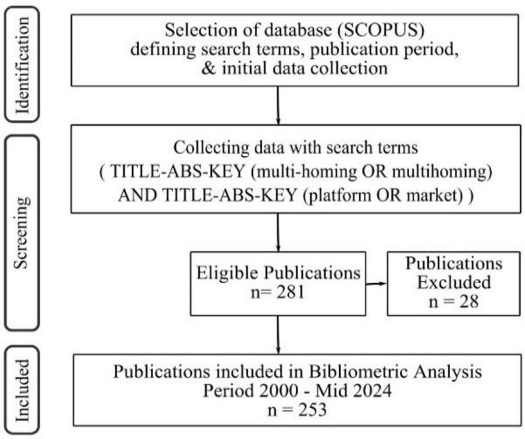

Fig. 1. Flow diagram to identify eligible studies.

The data source used in this research is publications indexed in Scopus. Scopus, managed by Elsevier Publishing, is one of the largest document indexers and one of the highest-quality information aggregators for academic papers. Scopus is a curated database where the content has undergone a rigorous selection and evaluation process to ensure that only high-quality data is included. The Scopus database is often the first choice for most bibliometric analyses [16], [17], [18].

The query string used for document search is (TITLE-ABS-KEY (multi-homing OR multihoming) AND TITLE-ABS-KEY (platform OR market)). This query is designed to find documents that contain two sets of terms. The first set is related to "multi-homing" or "multihoming," and the second set is related to "platform" or "market." The logical operators "OR" and "AND" ensure that the search results include documents discussing both aspects, specifically literature that examines multi-homing in the context of platforms or markets. The TITLE-ABS-KEY syntax is applied to the three main sections of the document: the title, abstract, and keywords.

The 'title, abstract, keywords' search in the Scopus database employed two sets of search terms. The first set relates to keywords associated with multi-homing, and the second set pertains to platforms or markets. The following query string was used for searching: (TITLE-ABS-KEY (multi-homing OR multihoming) AND TITLE-ABS-KEY (platform OR market)). This search term focuses on the main concepts relevant to the study

topic, namely multi-homing in the context of platforms or markets.

The document search was conducted in May 2024 and identified 281 documents published between 2000 and mid-2024 using two sets of search terms. The year 2000 was selected because it marks the first year of publication identified with these terms, specifically the paper by Crémer et al. [9].

Relevant studies were then selected, focusing on English-language documents categorized as journal articles and conference papers. This approach ensures access to high-quality and relevant information that has been published and peer-reviewed while also facilitating understanding. Applying these filters resulted in the selection of 253 documents for further analysis.

The selected papers were then analyzed through descriptive analysis and scientific mapping. Descriptive analysis provides information about the subject areas of the documents, the number of publications and citations per year, the most productive sources/journals, and the most influential papers. Meanwhile, scientific mapping was conducted by analyzing keywords to evaluate the occurrence of authors' keywords frequently used in the documents. In this paper, keyword clouds, keyword co-occurrence networks, and trend topic analyses were conducted. Based on the keyword co-occurrence network, cluster analysis was performed to identify trends in main topics or research fields. The researchers used VOSViewer (version 1.6.17) to visualize the keyword co-occurrence network, while Biblioshiny (R version 4.3.1, using the Bibliometrix package) was used to create visualizations such as word clouds and trend topics based on keywords.

3 Results and discussion

The following section presents the results of the bibliometric analysis based on 253 selected papers from the Scopus database. The first part explains the descriptive analysis to address the first research question (RQ1), while the second part contains a keyword analysis to answer the second research question (RQ2).

3.1 Descriptive analysis

3.1.1 Document type

Based on the 253 papers obtained, 161 (63.64%) were journal articles, and 92 (36.36%) were conference papers. This percentage indicates that journal articles dominate, accounting for 63.64% of the documents. However, there is also a considerable number of conference papers. Figure 2 depicts a combo chart, which combines a stacked column chart and a line chart showing the number of publications (green, yellow) and citations (blue) per year. The lower part of the column (green) represents journal articles, while the upper part (yellow) represents conference papers. The chart shows that there was a significant proportion in the early years. This trend may be due to the dynamic nature of the issue, leading researchers to prefer conferences to publish their findings more quickly.

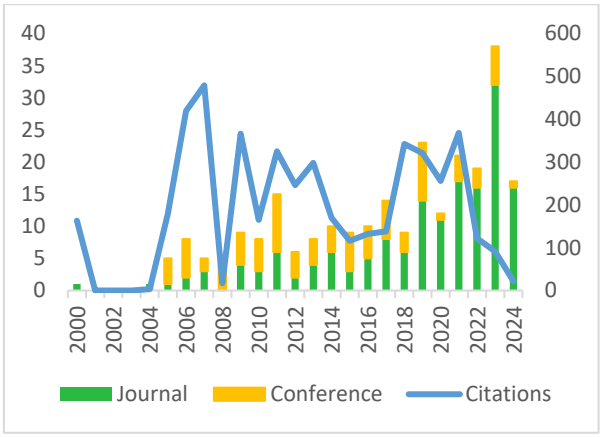

Fig. 2. Number of publications and citations per year .

3.1.2 Subject distribution

The subjects with the highest proportions were Computer Science (26.6%) and Business, Management, and Accounting (20.7%), followed by Economics, Econometrics, and Finance (13.5%), Engineering (13.1%), Decision Sciences (8.7%), Social Sciences (7.4%), and Mathematics (3.5%). The remaining subject areas each accounted for less than 3% of the publications.

Because a document may be classified under multiple subject areas, a single publication can fall into more than one category, reflecting its relevance across several disciplines. This classification shows that research on multi-homing is distributed across diverse fields. Some studies are associated with Computer Science and Engineering, while others are linked Business, Management, Accounting, Economics, Econometrics, and Finance.

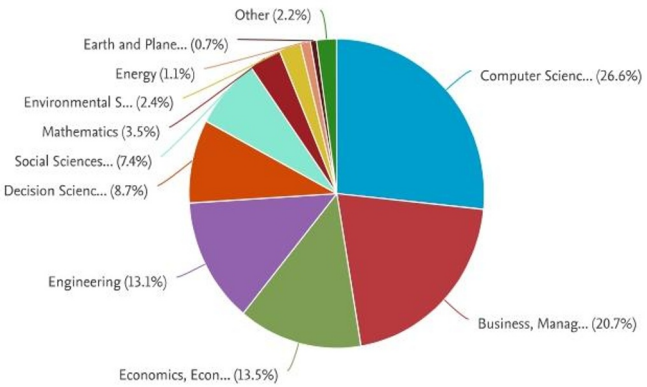

Fig. 3. Documents in subject areas.

3.1.3 Publication trend

Based on the combo chart in Figure 2, the column chart indicates a tendency toward an increasing trend in annual publications. This trend suggests an increase in the number of publications related to multi-homing in the context of platforms and markets. However, in 2024, the number of publications decreased because the year is only halfway through. The number of publications

may still increase by the end of the year. The blue line chart in Figure 2 represents the total annual citations, which shows a more fluctuating pattern.

3.1.4 Top sources

Table 1 shows the top ten sources publishing the most articles related to the phenomenon of multi-homing in the context of platforms and markets. The journal that published the most articles on this topic is *Management Science*, with 11 articles. Other significant contributors include the *Journal of Industrial Economics*, *the Journal of Economics and Management Strategy*, and *the International Journal of Industrial Organization*, each publishing six articles. The conference series that published the most articles are *Lecture Notes in Computer Science* (including the subseries *Lecture Notes in Artificial Intelligence* and *Lecture Notes in Bioinformatics*).

In Liu et al. [11], which conducted a bibliometric analysis of platform research over 30 years, it was found that four of the same journals—*Management Science*, *International Journal of Industrial Organization*, *Information Systems Research*, and *Internet Research*—also appear in the top ten journals. *Management Science*, a leading journal in management, has published high-impact papers in the field of multi-homing. Notably, the papers by [19] and [20] have received the highest total and average citations, as shown in Tables 2 and 3. Hagiu and Spulber [19] delve into first-party content investment strategies, while Bakos and Halaburda [20] explore subsidy strategies in multi-homing in two-sided markets.

Table 1. Most relevant sources.

Sources	J/C	N. of Docs
Management Science	J	11
Journal of Industrial Economics	J	6
Journal of Economics and Management Strategy	J	6
International Journal of Industrial Organization	J	6
Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)	C	6
Computer Networks	J	4
Information Systems Research	J	4
Internet Research	J	4
Marketing Science	J	4
40th International Conference on Information Systems, ICIS 2019	C	4
CEUR Workshop Proceedings	C	4

Note: J/C= Journal Article /Conference paper.

Table 2 lists 10 papers with the highest total citations (TC). These papers are most often referred to when discussing multi-side platforms and markets. They discuss mainly competition between platforms, concepts such as multi-homing, network effects, and network externalities. Meanwhile, Table 3 is a list of 10 papers that have the highest average number of citations. Average citations (AC) are calculated from the total number of citations divided by the time the paper was published.

Table 2. The top ten highest cited publications.

Journal	Author(s)	Year	TC
Economic Theory	Armstrong and Wright [21]	2007	357
RAND Journal of Economics	Hagiu [22]	2006	297
Journal of Economics a Management Strategy	Hagiu [23]	2009	229
Management Science	Hagiu and ; Spulber [19]	2013	207
Proceedings of the IEEE	Raychaudhuri and Mandayam [24]	2012	168
Journal of Industrial Economics	Crémer et al. [9]	2000	163
Information Systems Research	Cennamo et al. [25]	2018	162
Journal of Marketing	Landsman and Stremersch [8]	2011	139
Journal of Industrial Economics	Choi [26]	2010	126
International Journal of Industrial Organization	Doganoglu and Wright [10]	2006	114

Note: TC= Total citation.

Table 3. The top ten highest average cited publications.

Journal	Author(s)	Year	TC	AC
Journal of Management	Chen, et.al. [27]	2022	62	31
Information Systems Research	Cennamo, et.al. [25]	2018	162	27
Management Science	Bakos and Halaburda [20]	2020	87	21.75
Economic Theory	Armstrong and Wright [21]	2007	357	21
Manufacturing & Service Oper. Management	Bernstein et.al. [28]	2021	60	20
European J. Oper. Res.	Sui et.al. [29]	2023	19	19
Management Science	Hagiu and Spulber [19]	2013	195	18.82
International J. of Industrial Organization	Belleflamme and Peitz [30]	2019	87	17.4
RAND J. of Economics	Hagiu [22]	2006	297	16.5
European J. Oper. Res.	Wu and Chu [31]	2023	16	16

Note: AC= TC/year, TC= Total citation

3.2 Keyword analysis

Keywords in an article are terms or phrases selected by the author to summarize the topic or content discussed. In the scientific mapping conducted in this research, these keywords or phrases are used to identify the main topics and trend topics in studies related to multi-homing in platforms or markets.

Fig. 4. WordCloud of the keywords.

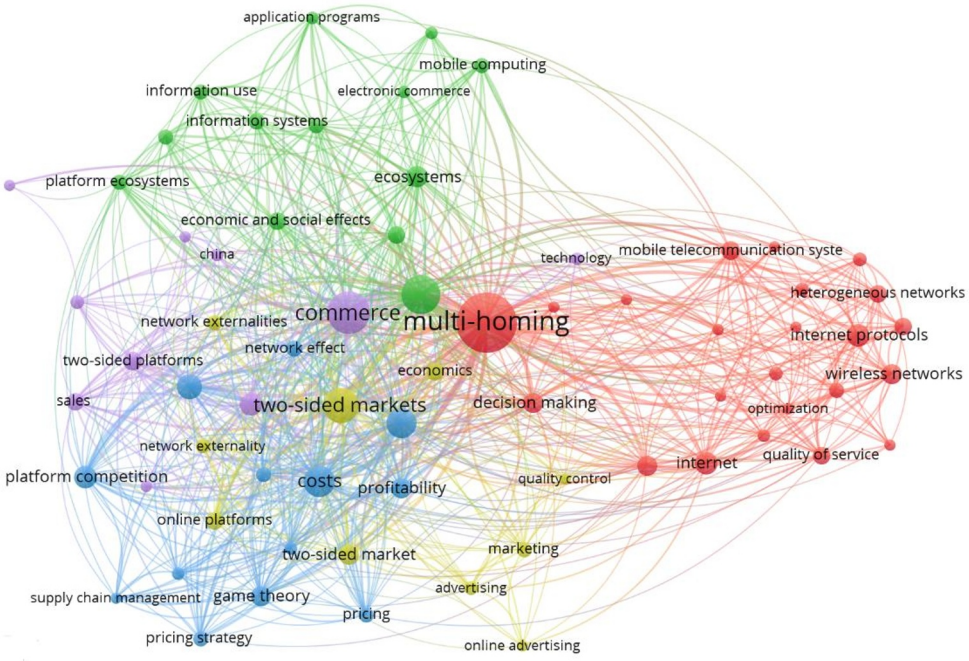

Fig. 5. Keywords co-occurrence network map of multi-homing in multi-sided platform studies.

A WordCloud provides a visual representation of the most frequently occurring keywords in the analyzed studies. Figure 4 displays the WordCloud constructed using the 30 most frequently used keywords. The size of the letters in the WordCloud reflects the frequency with which the keywords appear in the analyzed dataset. The larger the font size, the more often the word or phrase is used. Some of the most frequently appearing keywords include multi-homing (19%), commerce (11%), cost (6%), two-sided markets (6%), competition (5%), and others. Additionally, we derive the keyword frequency output from a summary table, although detailed specifications are not included here.

This study also investigates the keyword co-occurrence network to get a global view of research topics related to multi-homing in platforms and markets. Figure 5 shows the distribution of keywords in the network visualization. A co-occurrence network consists of nodes and links. Nodes represent keywords, and the size or size of the node is proportional to the frequency of appearance of the keyword. Links show the connection between one node and other nodes. In creating this map, we limited the minimum number of occurrences of a keyword to 5. Of the 1806 existing keywords, 69 meet the threshold. In Figure 5, five different colors show clusters of research keywords.

Items or keywords in The Cluster 1 (red) include "*always best connected, bandwidth, computer operating systems, gateways (computer networks), wireless networks, heterogeneous networks, network architecture, internet, internet protocol, internet service provider, mobile devices, telecommunication networks,*

resources allocation, quality of service, switching, and multi-homing". Multi-homing in this context refers to ensuring reliable, high-quality, and efficient connectivity. Several studies that discuss this topic include [32], [33], [34], [35]. [36]. These keywords relate to **network and telecommunications technology**, and strategies to manage and optimize telecommunications and internet networks.

A collection of keywords in Cluster 2 (green) includes "*application programs, digital platforms, mobile computing, ecosystems, software ecosystems, information use, information systems, platform ecosystems, multiple platforms, multi-homing strategies, and economic and social impacts*". Several studies discuss this main topic: [37], [38], [39]. These keywords relate to the main topic of **information systems and platform ecosystems** in the digital economy and management

The terms or keywords in Cluster 3 (blue) include "*competition, platform competition, network effect, network effects, costs, pricing, pricing decisions, pricing strategy, profitability, supply chain management, third parties, decision-making, and game theory*". Several studies that discuss this main topic are [29]. [31] .[40], [41]. This cluster relates to studies on **the network effects of platform competition**, particularly concerning decision-making on costs, pricing strategies, and profitability. The method most used in studies within this group is game theory.

Cluster 4 (yellow) keywords include "*advertising, economics, marketing, network externality, network externalities, online advertising, online platforms, two-sided market, and two-sided markets*". This set of keywords is related to the main topic, which discusses how network externality effects arise due to multi-homing behavior in two-sided markets. Relevant studies include [21], [10], [42], [43], [44]. [45]. Several studies use advertising and media markets in their analysis, such as in [42], [43], [44], [45]. This cluster focuses on **network externalities and their implications**, particularly in the context of advertising and marketing strategies.

In Cluster 5 (purple), keywords include "*China, commerce, competition (economics), competition strategy, sales, sharing economy, single-homing, platform governance, technology, and two-sided platforms*". This cluster relates to commerce, particularly the buying and selling of goods and services facilitated by digital platforms, which have transformed interactions between consumers and markets. It is also strongly connected to the sharing economy, an economic model in which assets and services are exchanged through digital platforms, enabling more efficient resource utilization and wider accessibility. Relevant studies include [28], [46], [47], [20]. Overall, this cluster is associated with **economic competition and platform governance** in the sharing economy. Understanding these dynamics is essential for explaining how today's economy operates, especially as it becomes increasingly shaped by technology and digital platforms.

Figure 6 displays the keyword co-occurrence network in the "overlay visualization" display mode. This image is like the previous one but uses different color details. The colors in this image show changes or developments based on time periods. Darker-colored nodes represent the beginning of the period, and lighter ones represent more recent research. This image provides helpful insight into studying research trends and topic developments based on periods.

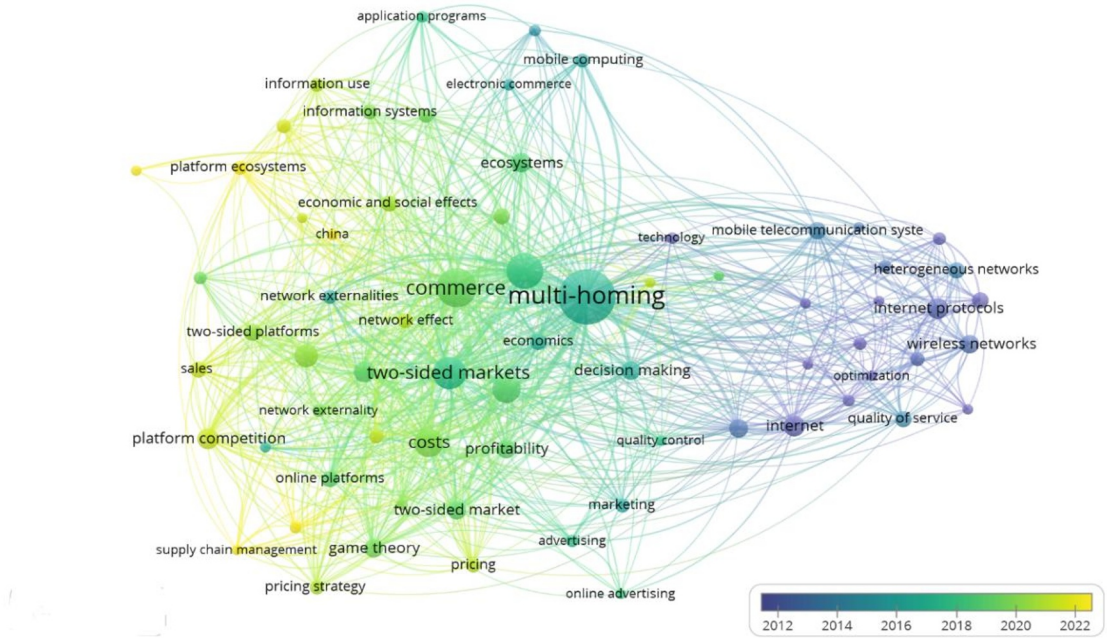

Fig. 6. Keywords co-occurrence network in the "overlay visualization" display mode.

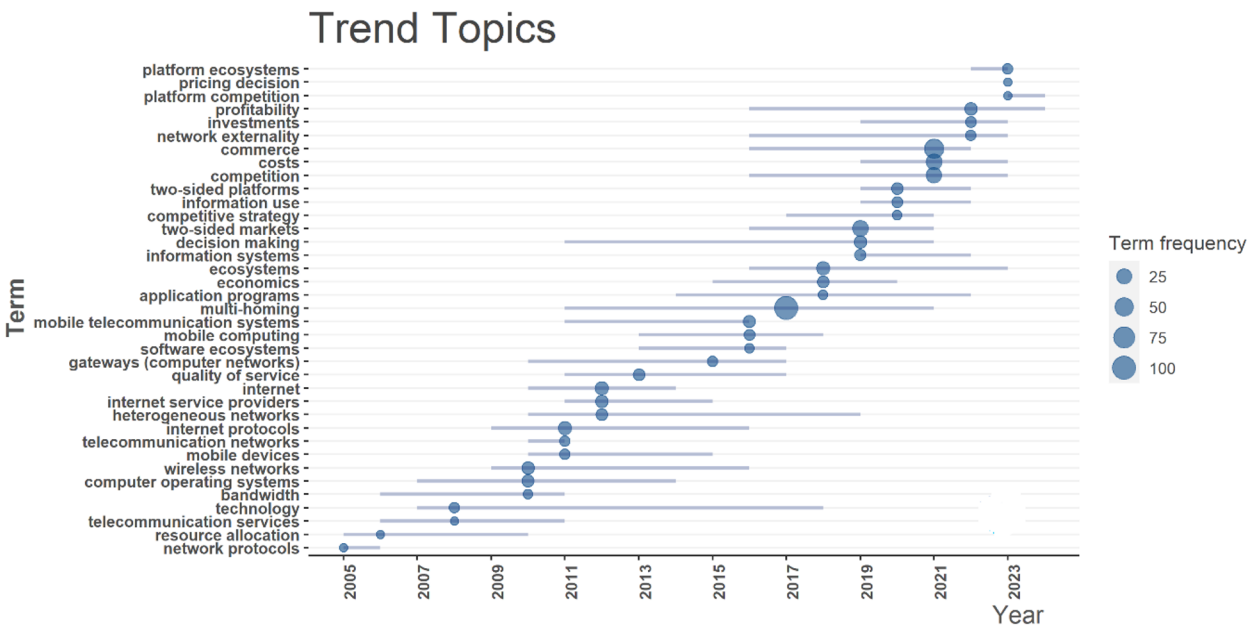

Fig. 7. Trend topics of multi-homing in multi-sided platform and m [21]studies.

Figure 7 is a trend topic graph that illustrates the keywords frequently appearing in research over a certain period. The size of the nodes represents the frequency of the keywords. Meanwhile, the lines indicate the time range, with the node in the middle representing the median, while the left and right boundaries represent the 1st Quartile (Q1) and the 3rd Quartile (Q3) of the years the articles were published [48].

Figure 7 shows that topics related to keywords such as network protocols, resource allocation, telecommunication services, technology, bandwidth, computer operating systems, wireless networks, mobile devices, telecommunication networks, internet protocols, heterogeneous networks, internet service providers, the internet, quality of service, and gateways (computer networks) were widely discussed multi-homing at the beginning of the period. Meanwhile, mid to late, the keyword discussion shifted to software ecosystems, mobile computing, mobile telecommunication systems, application programs, economics, ecosystems, information systems, information use, commerce, investments, pricing decisions, and platform ecosystems. This figure illustrates a shift in focus from technical aspects and network infrastructure at the beginning of the period to topics more related to information systems, platform ecosystems, and economic aspects. The figure of the keyword co-occurrence network in the 'overlay visualization' (Figure 6) shows a similar pattern.

The findings of this study are consistent with those of Rietveld and Schilling [14], who also demonstrated an increasing trend in the number of publications on platform competition. Rietveld and Schilling [14] conducted a systematic and interdisciplinary review of platform competition and documented four of the most common themes in this issue. These themes encompass the critical aspects of network externalities and their implications, platform ecosystems, user and complement diversity, and platform governance and orchestration.

The results of Liu et al. [11] who conducted a bibliometric analysis of platform research over 30 years, identified research themes by clustering based on co-citation and time zone analysis. Liu et al. [11] showed that the main theme in the period 2005-2010 was about two-sided markets, with representative papers such as Rochet and Tirole [49], [50], and Armstrong [21]. These papers discuss the dynamics of two-sided market competition, where multi-homing phenomena affect platform strategy. In 2015-2019, the end of Liu et al. [10]'s research period, the main theme focused on the sharing economy. In our research results, this topic is related to the main topic in cluster.

4 Conclusions

This study analyzes research publications from 2000 to May 2024 and shows a growing interest in multi-homing within multi-sided platforms and markets, reflected in the increasing number of highly cited publications. The review identifies five major research areas: (a) network and telecommunications technology, (b) information systems and platform ecosystems, (c) network effects in platform competition, (d) network externalities and their implications, and (e) economic competition and platform governance in digital platforms.

Theoretically, this study contributes by providing a comprehensive mapping of how multi-homing has evolved across disciplines and governance perspectives within platform ecosystems. These findings clarify the role of multi-homing in platform competition and sustainability.

The conclusions are based on 253 documents indexed in Scopus. Expanding the data set to include additional databases and document types could yield more comprehensive insights. Future research can strengthen the findings by incorporating additional databases, examining sector-specific contexts such as cloud services, online transportation, or the sharing

economy, and applying advanced analytical methods such as machine learning.

Overall, this study offers insights that can help researchers and practitioners better understand competitive dynamics and develop more effective strategies in multi-sided platforms. It is expected to enrich the literature on competition, governance, and multi-homing behavior in digital platforms, while encouraging further research in this field.

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