Bibliometric Analysis of Research Publications at Rajamangala University of Technology Isan: Trends and Patterns

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Abstract

Purpose: To analyze the research literature of Rajamangala University of Technology Isan over a period of 18 years to assess publication trends and research patterns.

Methodology: The study utilizes science mapping techniques, which enable the assessment of scientific information and identification of potential future research directions. A total of 1,693 documents indexed in Scopus were collected from the period of 2005-2023. The analysis focuses on various aspects, including citation information, bibliographical information, abstracts, keywords, and references.

Findings: The findings revealed significant contributions from the field of 'Engineering', which accounted for a substantial proportion of research publications. The subject areas of 'Physics and Astronomy', as well as 'Materials Science', also emerged as prominent domains within the university's research output. The analysis of publication trends over the years demonstrated an increasing trajectory, reflecting the growth and evolution of scholarly research at RMUTI.

Applications of this study: This study provides valuable insights for researchers, administrators, and policymakers in assessing research productivity, identifying influential authors and works, and fostering effective collaborations within the academic community. The comprehensive analysis of research publications at RMUTI contributes to evidence-based decision-making, enhances research strategies, and promotes scholarly impact.

Keywords: Bibliometric, Research trends, Research patterns, Rajamangala University of Technology Isan

1.   Introduction

Rajamangala University of Technology Isan (RMUTI) was founded in accordance with the Rajamangala University of Technology Act 2005, as specified in Section 36 of the National Education Act 1999. As a government educational institution, RMUTI operates as a juristic person and is mandated to offer degree programs. However, it operates under the oversight of the university council and does not possess complete autonomy in terms of administrative and academic affairs. To ensure effective administrative and academic management, it was deemed appropriate to establish nine sites of Rajamangala University of Technology rather than maintaining Rajamangala Institute of Technology. RMUTI, as one of the nine sites, focuses on professional and technological education. Its core objectives include providing academic programs, promoting academic advancement, emphasizing practical and hands- on professional training, conducting research, offering industrial and technical education, delivering academic services in the fields of science and technology, preserving arts and culture, and providing opportunities for vocational education students to pursue higher degree levels (RMUTI, 2022).

Publications serve as a means of facilitating knowledge exchange and disseminating the most recent advancements in specific research areas. Particularly in relation to Thailand's public universities, specifically Rajamangala University of Technology, publications in academic journals have been a focal point. Numerous research studies have been conducted globally to examine the scholarly publications of institutions, organizations, and specific fields. These studies employ various prominent publishers and databases such as ERIC, MathsciNet, PubMed, Scopus, Web of Science, JSTOR, and Project Muse (Chen, 2019; Kulkanjanapiban & Silwattananusarn, 2021; Davidescu et al., 2022; Md Yusop, 2022; Vlase & Lähdesmäki, 2023).

Bibliometrics plays a crucial role in evaluating scientific output. Studies utilizing this approach conduct analyses of intellectual networks to uncover trends within specific subjects or disciplines, identify prominent theories and productive scholars, map the intellectual landscape of a field (Pinto et al., 2014), and pinpoint gaps in knowledge (Gall et al., 2015). This is achieved by leveraging attributes or metadata such as titles, authors, affiliations, keywords, publication locations, and references (Abbasi et al., 2014; Van Raan, 2005). Research employing bibliometrics helps assess the current state and evolutionary trajectory of a particular field of study. One commonly employed form of bibliometrics is scientometrics, which involves quantitative assessments of networks encompassing ideas, academics, and

publications (Wang & Schneider, 2020). This approach relies on mathematical and statistical methodologies (Mao et al., 2018; Zhao et al., 2018) to map the spectrum of scientific literature. Scientometrics employs metrics, visual analysis, and indicators to elucidate noteworthy patterns, trends, and significant scientific shifts, aiding in the exploration and interpretation of intellectual structures and dynamic developments (Chen, 2017). Constructing networks based on bibliographic data enables the evaluation of impact and interdisciplinary connections (Ávila-Robinson & Sengoku, 2017).

To comprehensively understand the trends and patterns of publications and research in specific fields and institutions, several approaches have been employed, including big data analysis, scientometric analysis, and bibliometric study. Bibliometric analysis, in particular, is a widely used method to qualitatively and quantitatively evaluate the interest and impact of publications within a given field. Evaluating research publications plays a vital role in shaping future policies aimed at ensuring protection and adaptability in response to evolving circumstances (Donthu et al., 2021). Therefore, providing a contemporary perspective on RMUTI's research output, utilizing the Scopus database, will empower scholars to gain insights into prominent research institutions, trend topics, publication patterns, and social structure. This investigation will ultimately facilitate informed decision-making by university researchers and scholars when selecting educational institutions, while also enabling them to identify scholars whose work resonates strongly within the academic community.

2. Purpose

The primary aim of this investigation is to scrutinize the body of research publications originating from Rajamangala University of Technology Isan, with a specific focus on the systematic analysis of publication trends and patterns within the academic literature, in order to offer insights into the developmental trajectories of these publications. Remarkably, there exists a dearth of prior examinations concerning the productivity and impact of researchers affiliated with RMUTI within the Scopus database. Consequently, the central objective of this research endeavor is to assess the extent of Scopus coverage at the institutional level in relation to research productivity. The research inquiries posed can be succinctly delineated as follows:

RQ1: What is the trend of scholarly papers authored or co-authored?

RQ2: To depict the growth of research production for RMUTI

RQ3: To estimate the authorship pattern of the publications

RQ4: To identify the authors' productivity

RQ5: To recognize the core sources for research communication

3.   Methodology

3.1   Data Collection

This study employed a quantitative research design to conduct a bibliometric analysis of research publications originating from Rajamangala University of Technology Isan (RMUTI). The bibliometric approach facilitated a systematic examination of publication trends, citation patterns, and collaborative networks within the university's research output. The research methodology relied on bibliometric techniques, involving a comprehensive analysis of RMUTI's literature. A specific search string, "AF-ID ("Rajamangala University of Technology Isan")," was employed, leading to the identification of 1,693 publications affiliated with RMUTI. For data retrieval and collection, the research utilized Bibliometrix and Biblioshiny, software packages integrated with RStudio, which interfaced with the Scopus API to automatically compile a list of scholars' research outputs. Subsequently, the data were processed using Biblioshiny within the Bibliometrix package for R. Visualization graphs depicting citations.

3.2   Sample Selection

The study sample consisted of research publications associated with Rajamangala University of Technology Isan. To ensure the inclusion of relevant publications, a filtering process was implemented based on the affiliation information provided in the Scopus database. Only publications that satisfied this criterion were included in the analysis.

3.3   Variables

The bibliometric analysis focused on several key variables, namely publication volume, citation counts, authorship patterns, collaboration networks, and subject areas of research. These variables were instrumental in assessing the research productivity, impact, and disciplinary emphasis of the university's publications.

3.4   Data Analysis

All bibliographic data, including citation information, abstracts, keywords, funding details, and other relevant information, were meticulously recorded and exported in Excel format (.csv) for the purpose of conducting citation analysis and bibliographic coupling to discern trends in papers published by researchers affiliated with Rajamangala University of

Technology Isan (RMUTI). Subsequently, the dataset underwent thorough analysis utilizing an Excel spreadsheet, Bibliometrix. To assess the impact of publications and identify influential authors and works, a citation analysis was conducted. Additionally, network analysis was carried out using an R-Tool tailored for bibliometric analysis, unveiling collaboration patterns among authors, institutions, and countries, as elucidated by Aria and Cuccurullo (2017).

4.   Research results

The bibliometric analysis conducted in this study encompasses six distinct categories, each comprising several sub-categories. These main categories include: 1) Main Information, 2) Publication by Subject Area, 3) Sources, 4) Authors, 5) Documents, and 6) Clustering by Coupling and Network. Under the Authors category, sub-categories such as Most Relevant Authors, Top-Author's Production over Time, and Collaboration Network were developed. The findings of this study hold significant importance as they provide valuable bibliometric information that enables the identification of high-impact research contributing to the generation of new knowledge at RMUTI. The dataset extracted from the Scopus database consists of 1,693 documents authored by 2,982 individuals within the timeframe spanning from 2005 to July 2023.

Table 1. Main information about the collection

Timespan	2005 to 2023
Sources	716
Documents	1,693
Annual Growth Rate	30.71%
Authors	2,982
Authors of single-authored documents	39
International Co-Authorship	20.97%
Co-Authors per Doc	4.59
Author's Keywords (DE)	5,070
References	47,064

Document Average Age	4.74
Average citations per doc	7.581

Table 1 provided encompasses a timespan from 2005 to 2023 and is based on 716 different sources. Within this dataset, a total of 1,693 documents were analyzed. The annual growth rate of these documents was determined to be 30.71%, indicating a significant increase in scholarly output over time. The number of distinct authors involved in producing these documents amounted to 2,982 individuals. Out of the total number of documents, 39 were authored by a single individual without any collaboration. The international co-authorship rate, representing the proportion of documents with authors from different countries, was calculated to be 20.97%. On average, each document had 4.59 co-authors. The authors provided 5,070 unique keywords (DE) to describe their research topics. Additionally, a total of 47,064 references were cited in the documents, indicating a comprehensive engagement with existing literature. The average age of the documents within the dataset was determined to be 4.74 years, implying that the research being analyzed was relatively recent. Furthermore, each document received an average of 7.581 citations, reflecting its impact and influence within the scholarly community.
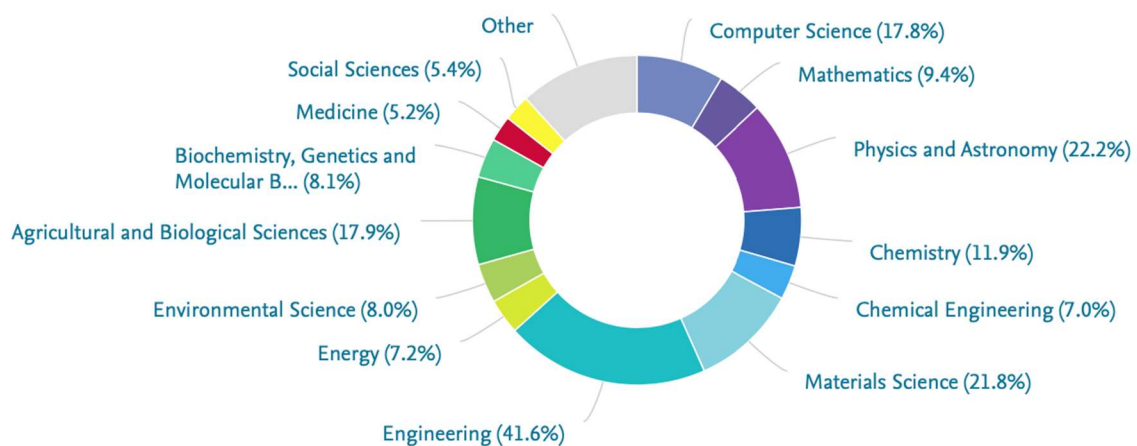

Figure 1. Publication share by subject area

Figure 1 presents a visual representation illustrating the distribution of publications across various scientific fields. The largest proportion of publications is in the field of engineering, accounting for 41.6% of the total. Following closely is computer science with 17.8%, mathematics with 9.4%, physics and astronomy with 22.2%, and chemistry with 11.9%.

The remaining 5.4% of publications encompass several subject areas, including social sciences, medicine, biochemistry, genetics, and molecular biology, agricultural and biological sciences, environmental science, and energy.

The figure provides valuable insights into the relative proportions of different scientific categories. Notably, it highlights the dominance of engineering in terms of publication output. This prominence can be attributed to the broad and interdisciplinary nature of the field, covering diverse topics and its practical applications with real-world implications. Additionally, the figure underscores the limited representation of publications in certain subject areas. For instance, the social sciences account for only 5.4% of publications, suggesting a relatively lower presence in the scientific literature. This disparity could stem from various factors, including the inherent challenges associated with conducting rigorous research in social sciences or the relatively lesser allocation of funding towards social science research.
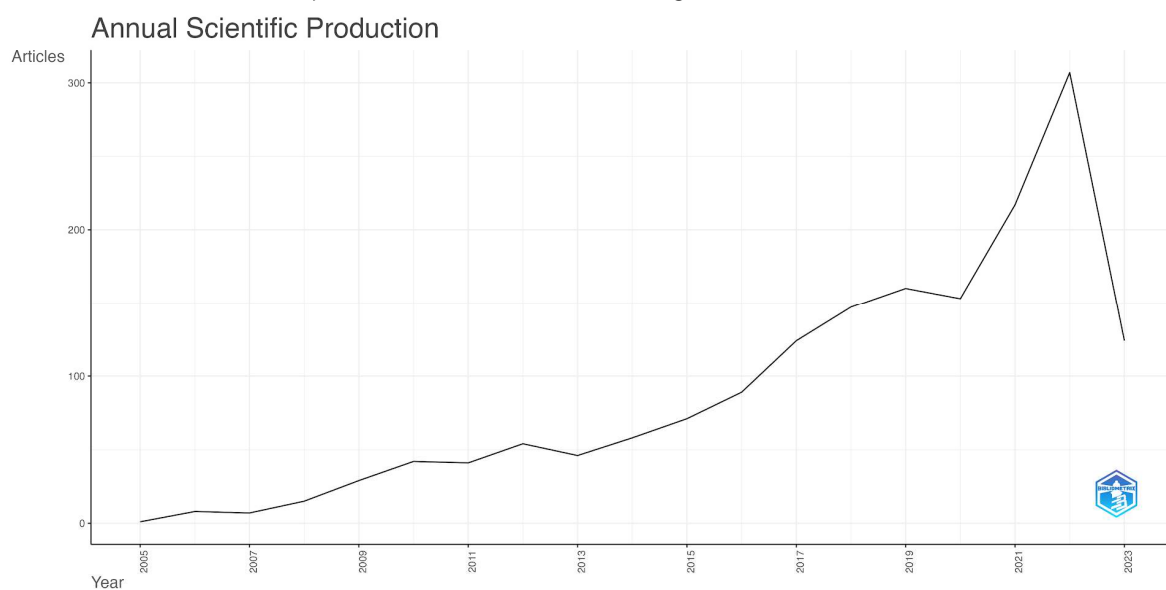

Figure 2. Annual scientific production

Figure 2 illustrates a graphical depiction of the number of articles published each year from 2005 to 2023. The line graph clearly demonstrates a noticeable upward trend in article publications as the years progress. In 2005, only one article was published, whereas in subsequent years, the number of articles experienced a notable rise.

From 2006 to 2023, the publication numbers progressively increased, with some fluctuations observed in certain years. In particular, there were substantial increments in article publications between 2008 and 2010, followed by a more consistent upward trend from 2011

to 2023. In recent years, the number of articles published has been consistently high, with notable peaks in 2021 and 2022. In 2023, however, the number of articles decreased compared to the preceding year. This figure highlights the growth and fluctuation patterns in article publications over the specified time period, reflecting the evolving landscape of scholarly research in the subject area.
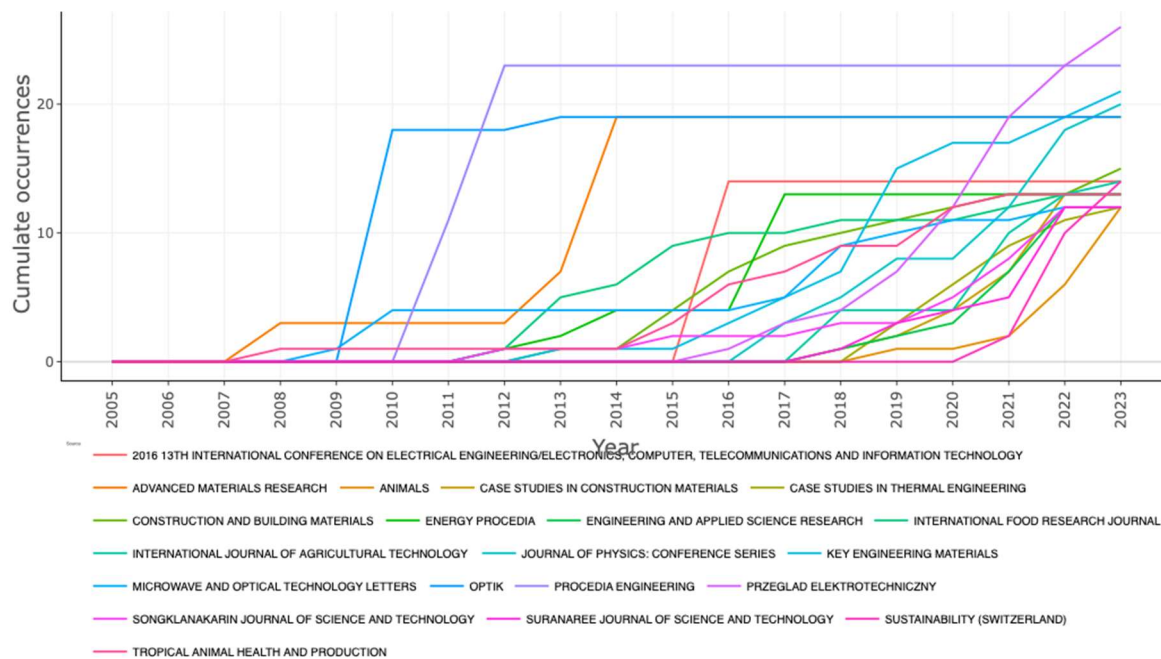

Figure 3. Sources' Production over Time

Figure 3 consists of the number of articles published in various academic journals or conference proceedings across different years. The data reflects the publication counts for each year and venue. It reveals the varying levels of article publications within different venues over the years. From 2005 to 2023, certain venues consistently recorded no publications. For instance, "PRZEGLAD ELEKTROTECHNICZNY," "PROCEDIA ENGINEERING," and "KEY ENGINEERING MATERIALS" had no publications throughout the entire time frame. In contrast, other venues demonstrated more substantial publication activity. For example, the venue "JOURNAL OF PHYSICS: CONFERENCE SERIES" exhibited a progressive increase in publications over the years. The figure also reveals fluctuations in publication patterns within specific venues. For instance, "OPTIK" and "CONSTRUCTION AND BUILDING MATERIALS" showcased varying publication counts over the years, with some years having no publications while others had several. Furthermore, some venues experienced steady growth in publications. Notably, "TROPICAL ANIMAL HEALTH

AND PRODUCTION" and "ANIMALS" displayed consistent increases in the number of articles published each year.
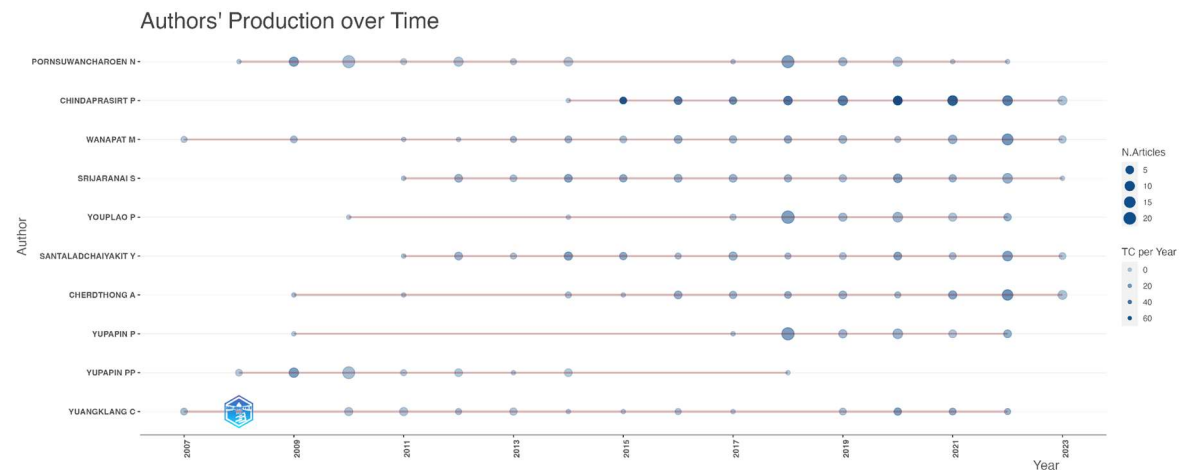

Figure 4. Authors' Production over Time

Figure 4 provides an overview of the production patterns of different authors over time. It starts by examining the author CHERDTHONG A, who began publishing in 2009 with one paper and accumulated a total of 67 citations. The average citations per year for this author were 4.467. The frequency of publications and citation counts varied over the years, with a peak of eight publications but only four citations in 2023. CHINDAPRASIRT P, on the other hand, started in 2014 with one publication and four citations, resulting in an average of 0.400 citations per year. However, in subsequent years, both the frequency of publications and citation count increased significantly, reaching a peak of eight publications and 247 citations in 2020. The production of PORNSUWANCHAROEN N showed variations over the years, with a decline in recent times. Starting with one paper and two citations in 2008, the average citations per year were 0.125. The frequency of publications increased in subsequent years, peaking at 22 publications in 2010, but the citation count remained relatively low, with an average of 5.786 citations per year. SANTALADCHAIYAKIT Y demonstrated a more consistent production pattern, with an increasing trend in both frequency and citation count until 2020. Starting in 2011 with one paper and 66 citations, the average citations per year were 5.077. The frequency and citation count varied over the years but generally showed an upward trajectory, reaching five publications and 75 citations in 2020. The remaining authors, including SRIJARANAI S, WANAPAT M, YOUPLAO P, YUANGKLANG C, YUPAPIN P, and YUPAPIN PP, also exhibited varying

production patterns, with fluctuations in both frequency and citation counts. Each author had their own unique trajectory, experiencing peaks and valleys in their careers.
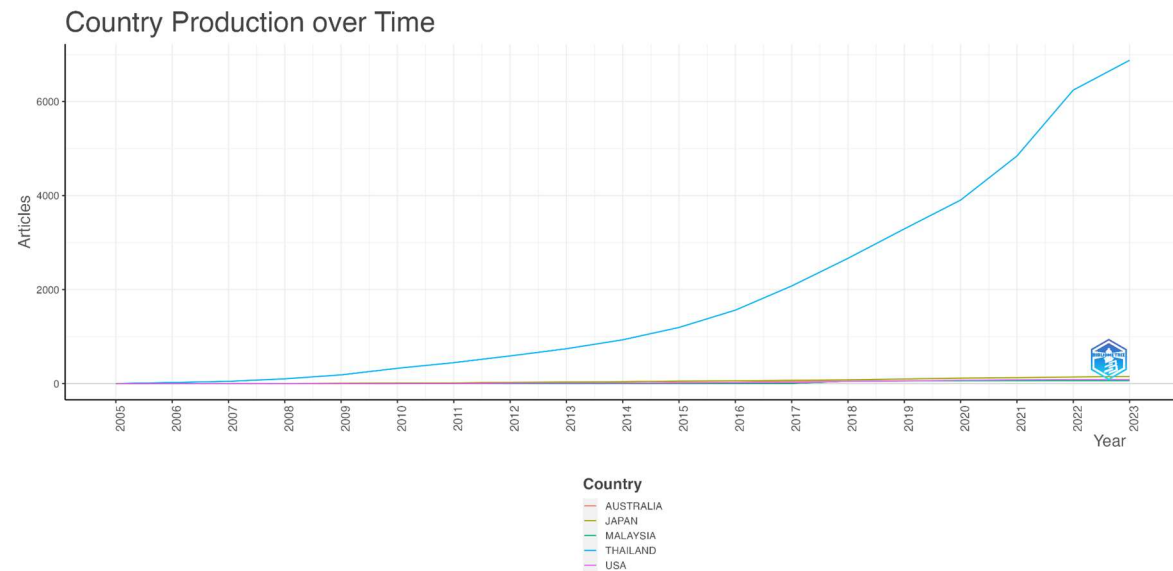

Figure 5. Country Production over Time

The provided line graph in Figure 5 depicts the quantity of articles published in various countries and years. The countries featured in the graph are Australia, Japan, Malaysia, Thailand, and the USA. Each line corresponds to a specific country, year, and the corresponding number of articles published during that period. In Thailand, the number of articles published has steadily increased over the years. In 2005, there were only 2 articles, but by 2023, the number had reached 6,878. The growth in publications demonstrates the increasing research output and scholarly activity in Thailand. Japan also experienced an upward trend in publications, although the number of articles published was generally lower compared to Thailand. The number of articles increased from 3 in 2007 to 152 in 2023. Malaysia had a more modest publication record, with a relatively stable number of articles published over the years. The number ranged from 2 in 2009 to 64 in 2023. Australia had a similar pattern to Malaysia, with a lower number of articles published. The publication count increased from 1 in 2011 to 80 in 2023. The USA exhibited a higher publication output compared to the other countries in the dataset. The number of articles published increased steadily from 3 in 2011 to 89 in 2023.
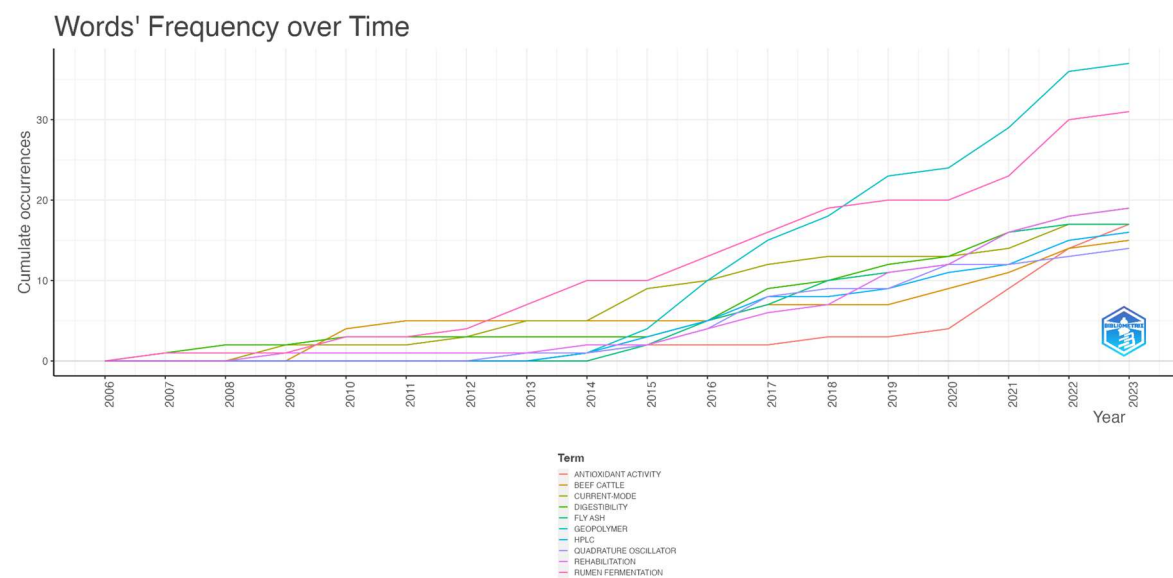
Figure 6. Words' Frequency over Time

The line graph in Figure 6 displays data on the frequency of mentions for diverse academic topics across multiple years. It unveils significant patterns and changes in research interests within the academic community over time. The data signifies a comprehensive representation of scholarly attention directed towards specific subjects over time, shedding light on their relative importance and evolving significance within academic discourse. The analysis highlights the emergence and growth of several topics, such as "geopolymer," "rumen fermentation," and "antioxidant activity." These concepts experienced an upward trajectory in terms of their frequency of mentions, indicating a heightened research focus and increasing significance in academic investigations. On the other hand, certain topics, like "current-mode" and "quadrature oscillator," exhibited relatively consistent mentions throughout the years, suggesting sustained interest but possibly within more specialized or niche areas of study. The stable frequency of mentions for these topics implies ongoing research efforts and a dedicated community of scholars investigating these subject matters. Furthermore, the data reveals the persistence of various themes over time, such as "digestibility" and "rehabilitation." These topics maintained a consistent presence throughout the years, indicating their enduring relevance within academic domains and the sustained interest in exploring and understanding their intricacies. Additionally, the data reflects the progression and evolution of certain topics. For instance, "fly ash" experienced an upswing in mentions starting from 2015, indicating a growing recognition and research emphasis on its environmental and construction-related

aspects. Similarly, "HPLC" (high-performance liquid chromatography) demonstrated a gradual increase in mentions, showcasing the continued significance of this analytical technique in scientific investigations.
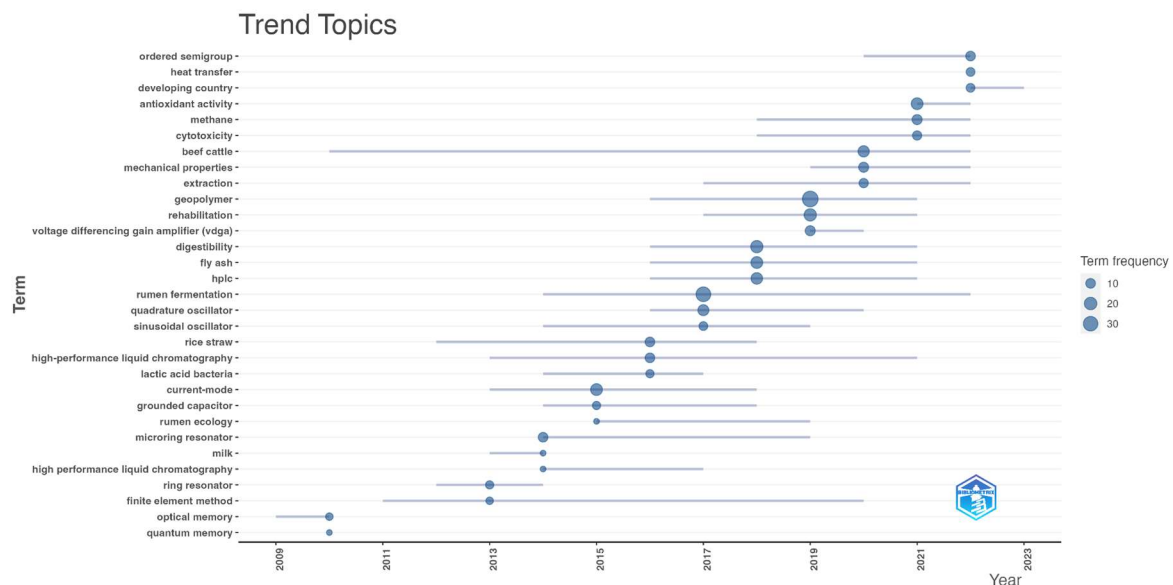

Figure 7. Trend Topics

The terms provided in Figure 7 include various items or topics and the quartiles of the years in which they were mentioned. Some items related to technology and memory, such as "optical memory" and "quantum memory," had relatively lower frequencies of 6 and 5, respectively. These topics were mainly mentioned around the years 2009-2010. Other items like "ring resonator" and "finite element method" had frequencies of 7 and 6, respectively. "Ring resonator" appeared more frequently around 2012-2014, while "finite element method" had a broader range from 2011 to 2020. "Microring resonator" had a higher frequency of 10 and was mostly mentioned in the years 2014-2019, indicating its significance in the field. There were also items related to scientific techniques and analysis, such as "high-performance liquid chromatography" (HPLC). HPLC had frequencies of 5 and 10, and the mentions were concentrated between 2013 and 2021. Some agricultural topics, like "rumen ecology" and "rice straw," had frequencies of 5 and 10, respectively. These topics were discussed mainly in the years 2015-2019, indicating their relevance in the agricultural research domain. Other items, including "rehabilitation," "geopolymer," and "mechanical properties," had frequencies ranging from 8 to 37. These topics were mentioned over a span of years, reflecting their significance and continued research interest. Additionally, there were items related to various fields such

as chemistry ("antioxidant activity," "methane," "cytotoxicity"), mathematics ("ordered semigroup"), and broader topics like "developing country" and "heat transfer." These items had frequencies ranging from 8 to 19, and their mentions were spread across different years.
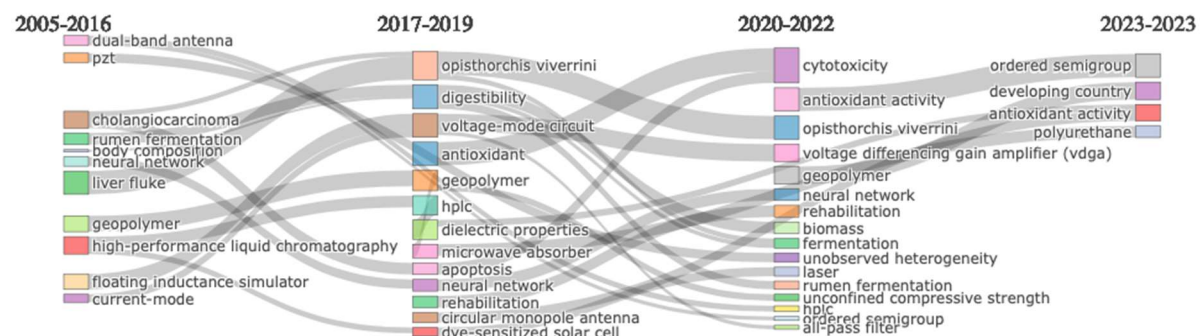

Figure 8. Thematic Evolution

The thematic evolution in Figure 8 presents a summary of transitions between different terms across various time periods, along with corresponding weighted inclusion indices, inclusion indices, occurrences, and stability indices. These transitions represent changes in research focus and associations within specific domains. For instance, the transition from "liver fluke" to "opisthorchis viverrini" during 2005-2016 and 2017-2019 led to the emergence of similar terms during 2020-2022. This transition had a weighted inclusion index of 0.17 and an inclusion index of 0.08, indicating a moderate association between the terms. Similarly, the transition from "antioxidant" to "cytotoxicity" showed a strong association with the term "apoptosis" in the latter period, with a weighted inclusion index and inclusion index of 0.50. Another interesting transition occurred between "geopolymer" and "geopolymer," which were associated terms during the period of 2016-2019. This transition had a higher weighted inclusion index of 0.67, suggesting a strong connection between the terms. Furthermore, the transition from "high-performance liquid chromatography" to " HPLC" in 2016-2019 emphasized the continued association of the term "HPLC," which had a weighted inclusion index and inclusion index of 0.30 and 0.33, respectively.

Country Collaboration Map

Figure 9. Country Collaboration Map

The country collaboration map in Figure 9 shows the frequency of country transitions in academic contexts. It reveals the level of interaction and collaboration between countries. Notable observations include the frequent transitions between Thailand and the USA, Thailand and Japan, and Thailand and China, indicating strong academic connections. The map also highlights collaborations between Malaysia and India, as well as Malaysia and the USA. Additionally, Thailand shows consistent academic engagement with Australia, India, and the United Kingdom.

5.   Conclusion

This research article presents a comprehensive bibliometric analysis of research publications at Rajamangala University of Technology Isan (RMUTI). By examining publication trends, collaboration patterns, journal and conference preferences, and citation impact, this study contributes to the understanding of research productivity and scholarly impact at RMUTI. The findings of this study serve as a valuable resource for informed decision-making in research strategies and collaborations. The outcomes of this study have implications for enhancing research productivity and scholarly impact at RMUTI, as well as for facilitating evidence-based research strategies and fostering collaborations in the academic community. Moreover, this research establishes a foundation for future research endeavors in the field of bibliometrics, enabling further exploration and advancement of knowledge in this area.

Nevertheless, this study primarily focused on examining RMUTI's publications solely within the Scopus databases, thereby limiting its scope to include publications from other databases, consequently restricting a comprehensive overview of RMUTI's publications. Furthermore, the bibliometric analysis cantered on scrutinizing aspects such as publication volume, citation counts, authorship patterns, collaboration networks, and subject areas within the university. However, the research findings lacked an in-depth analysis of the research outcomes and the specific content within these research publications. Therefore, to expand on the current research and provide a more holistic understanding of RMUTI's research landscape, the future research could be considered to conduct a comparative study across multiple databases, perform an in-depth content analysis of select publications, evaluate the impact of RMUTI's research on policy development, industry practices, and societal advancements.

6.   Discussion

Evidently, the research highlights a substantial surge in the annual document growth rate at Rajamangala University of Technology Isan over the past 18 years, showing a remarkable increase of 30.71%. This growth trend indicates a deliberate emphasis by RMUTI on promoting publication in Scopus-indexed journals among their researchers. Notably, disciplines such as engineering, material sciences, computer science, physics and astronomy, as well as agricultural and biological sciences, stand out as the primary areas of publication at RMUTI. However, the domains of energy, medicine, and social sciences exhibit relatively fewer articles published on Scopus. Therefore, it is imperative for RMUTI to establish effective policies and protocols aimed at fostering growth in fields with limited publication rates.

Furthermore, Cherdthong A, Chindaprasirt P, Pornsuwancharoen N, Santaladchaiyakit Y, Srijaranai S, Wanapat M, Youplao P, Yuangklang C, Yupapin P, and Yupapin PP emerge as the leading contributors to RMUTI, surpassing others in terms of publication rate. Hence, the question of how to inspire researchers to persist in conducting high-quality research initiatives, thereby enhancing RMUTI 's research capability and performance, assumes critical significance.

Within the publications at RMUTI, authors engage in diverse collaborative networks with numerous countries, with the United States, Japan, and China emerging as the foremost nations in these collaborations.

Regarding the research trends at RMUTI from 2005 to 2023, the notable findings indicate that the majority of the university's research focuses primarily on scientific subjects. These topics include areas such as "optical memory," "quantum memory," "ring resonator," "finite element method," "Microring resonator," "high-performance liquid chromatography," "rumen ecology," and "rice straw," among others. Thus, RMUTI could consider implementing several solutions to further enhance its academic and research standing.

In comparison, the related works explore various aspects, such as the impact of the pandemic on academic performance and well-being, research trends and impacts at specific universities, dominance of certain research fields, and collaboration patterns in cultural heritage research (Davidescu et al., 2022; Md Yusop, 2022; Vlase & Lähdesmäki, 2023). These findings collectively contribute to a comprehensive understanding of research productivity, impact assessment, disciplinary focus, and collaboration patterns within academic settings. Moreover, the related works offer valuable insights into specific disciplinary research areas, such as government research and development activities and academic social networks. The exploration of academic social networks beyond co-authorship and co-inventorship networks highlights their influence on research collaborations (Chen, 2019). These insights broaden the understanding of collaboration dynamics and mechanisms within academic settings. By drawing connections and highlighting commonalities and differences with the related works, the discussion section of the current study contributes to the academic discourse on research productivity, impact assessment, disciplinary focus, and collaboration patterns in various academic environments. The synthesis of findings from different studies enriches the understanding of research practices and dynamics within academic settings. This comprehensive perspective provides valuable insights for future research endeavors and informs decision-making processes related to research strategies and collaborations.

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