Research Article

A Bibliometric Analysis of Khon Kaen Agriculture Journal (KAJ): Research and Trends[1]

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Abstract

The purpose of this study is to examine the research trends published in Khon Kaen Agriculture Journal (KAJ) from 2013 to 2022 by analysing the most productive authors, affiliations, and most cited articles. This research employed bibliometric analysis methods, including performance analysis, which consists of displaying the number of articles published, authors with a large number of published works, and affiliations of the authors writing the most frequently published research. The VOSviewer was utilized to demonstrate the keyword co-occurrence science mapping and the Looker Studio was used to exhibit analysis and to visualize the results in the form of tables, diagrams, and graphs. According to the findings, there are 990 articles published from 2013 to 2022. There was a consistent increase in the number of publications each year. Analysis of the article data classified by the affiliations of the authors shows that authors from Nakhon Ratchasima Rajabhat University and Silpakorn University Phetchaburi IT Campus published the most research articles. The highest number of citations was found in 2014, with 79 citations among 56 articles. The authors are from four different countries: Thailand, Laos, Bangladesh, and China. Khon Kaen University's affiliate has contributed the most publications. Additionally, VOSviewer visualization also illustrates the data to exhibit 12 clusters of keyword co-occurrence, and the term "Livestock Production" remains one of the most important sectors, that are related world's most important sectors concerning economy, food security, and the livelihoods of people.

Keywords: Bibliometric; Bibliometric analysis; Document analysis; Agriculture data analysis; Data visualization.

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บทคัดย่อ

การศึกษานี้มีวัตถุประสงค์เพื่อสำรวจแนวโน้มงานวิจัยที่ตีพิมพ์ในวารสารแก่นเกษตร ตั้งแต่ พ.ศ. 2556-2565 ทำการวิเคราะห์ผู้แต่งที่มีผลงานตีพิมพ์สูงสุด หน่วยงานของผู้แต่ง และบทความที่มีผู้อ้างอิงถึงมากที่สุด งานวิจัยนี้ใช้วิธีการวิเคราะห์ทางบรรณมิติ ประกอบด้วย การวิเคราะห์สมรรถนะ ได้แก่ การแสดงจำนวนบทความที่ตีพิมพ์ ผู้แต่งที่มีผลงานตีพิมพ์สูงและสังกัดของผู้วิจัยที่ได้รับการตีพิมพ์สูงสุด ใช้โปรแกรม VOSviewer เพื่อแสดงแผนที่การอ้างอิงงานวิชาการด้วยคำสำคัญที่ปรากฏร่วม และใช้ Looker studio เพื่อแสดงการวิเคราะห์และแสดงภาพข้อมูลในรูปแบบของตาราง ไดอะแกรมและกราฟ จากผลการวิจัยพบว่า มีบทความที่ตีพิมพ์ระหว่าง พ.ศ. 2556-2565 จำนวน 990 บทความ และในแต่ละปีมีจำนวนสิ่งพิมพ์เพิ่มขึ้นอย่างต่อเนื่อง จากการวิเคราะห์ข้อมูลบทความ จำแนกตามหน่วยงานของผู้แต่งพบว่า ผู้แต่งจากมหาวิทยาลัยราชภัฏนครราชสีมาและมหาวิทยาลัยศิลปากร วิทยาเขตสารสนเทศเพชรบุรี ได้รับการตีพิมพ์บทความวิจัยมากที่สุด มีการอ้างถึงมากที่สุดในปี พ.ศ. 2557 โดยมีการอ้างถึง 79 ครั้ง จากบทความทั้งหมด 56 บทความ มีผู้แต่งจาก 4 ประเทศ ได้แก่ ไทย ลาว บังคลาเทศ และจีน โดยมหาวิทยาลัยขอนแก่น มีผลงานตีพิมพ์มากที่สุด นอกจากนี้โปรแกรม VOSviewer ยังแสดงภาพข้อมูลกลุ่มคำสำคัญที่ปรากฏร่วม 12 กลุ่ม พบประเด็น "การผลิตปศุสัตว์" ยังคงเป็นประเด็นที่มีความสำคัญมากที่ถูกค้นพบในการวิจัยนี้ ซึ่งเป็นประเด็นที่สอดคล้องการวิจัยที่สำคัญของโลกที่เกี่ยวข้องกับเศรษฐกิจ ความมั่นคงทางอาหารและการดำรงชีวิตของผู้คน

คำสำคัญ: บรรณมิติ; การวิเคราะห์บรรณมิติ; การวิเคราะห์เอกสาร; การวิเคราะห์ข้อมูลทางเกษตรศาสตร์; การนำเสนอภาพข้อมูล.

Introduction

Bibliometric analysis involves the use of mathematical statistics to examine bibliometric data such as publications and citations, allowing for both qualitative and quantitative analysis of particular disciplines or fields of study. This analysis enhances the identification of evolutionary trends and emerging areas within the disciplines or fields of study (Donthu et al., 2021). A bibliometric analysis is a mechanism to evaluate the quality of research findings. This includes the research potential of particular researchers and research centres (Zupic & Cater, 2015), academic competence, productivity, and influence of their publications in an abundance of ways (Sawangkul, Pinitpuwadol, Sakiyalak, & Choopong, 2020). It is also utilized for creating knowledge maps, which illustrate the structure and dynamics of knowledge in a wide range of domains (Zupic & Cater, 2015).

This technique has been widely used in the field of agriculture. By describing the knowledge base, characteristics, and trends through bibliometric analysis, it is possible to create a comprehensive overview of the studies in the agriculture field. Hu et al. (2023) explained that bibliometric analysis primarily concentrated on agricultural systems, the ramifications of climate change on global agricultural systems, the significance of sustainable agricultural practices, and approaches for precision agriculture. For example, Shah (2016) utilized a bibliometric analysis for articles published in six volumes of the International Journal of Agriculture Sciences from 2009 to 2014. The analysis covered the distribution of articles over the years, authorship patterns, geographical distribution, country-wise contributions, prolific contributors, average references per article, the types of documents referenced, and the age of references. Mao et al (2018) investigated the research patterns surrounding the restoration of polluted soil and discerned the focal points and emerging patterns, thereby furnishing a roadmap for forthcoming research avenues. Pan et al. (2021) examined the current patterns in soil nutrient studies. This involved an analysis of prominent journals, institutions, and countries, alongside the identification of key subjects within this field. Uma et al (2021) evaluated agricultural accounting research spanning the last 93 years, examining the publication frequency, subject areas, focal topics capturing the most attention from researchers, and the institutions actively contributing to this field. Li and Zhang (2022) employed a bibliometric analysis and visualization review of literature related to agricultural ecosystem services, focusing on environmental pollution issues caused by agricultural production. The study identified countries and institutions with the highest publication numbers, highlighted influential authors and publications through citation analysis, and conducted keyword visualization to reveal three theme clusters in existing research. The findings also summarized research trends and anticipated future topics in this academic field. Zhang, Liu, & Zhang (2023) provided a more extensive understanding of the progression patterns that have emerged in the domain of research on the mineralization of organic carbon in agricultural soil over the course of the past 22 years.

This article, therefore, aims to analyze the agriculture research trends in Khon Kaen Agriculture Journal (KAJ), an indexed journal published by the Faculty of Agriculture, Khon Kaen University. The objectives of this article encompass quantifying the published articles, identifying authors with high publication and highly

cited articles, exploring the most frequent affiliations of the authors, and examining the prevalent issue within Khon Kaen Agriculture Journal (KAJ). The utilization of the bibliometric technique and data visualization technique in this study will provide significant and valuable insights into the current research trends in agriculture in Khon Kaen Agriculture Journal (KAJ). Consequently, researchers who are interested in the Khon Kaen Agricultural Journal can access the studies and advance research in new perspectives by combining innovative methods and tools for analysis and visualization development**.**

Objectives

1. To analyze the bibliometric data of Khon Kaen Agriculture Journal (KAJ) from 2013 to 2022.

2. To visualize the research performance analysis.

Research Methodology

This article involved bibliometric analytics techniques using agriculture research articles from Khon Kaen Agriculture Journal in the TCI-ThaiJo database from 2013 to 2022. The article employed the methods outlined in the research by Zupic and Cater (2015), as shown below.

1. Research design

The purpose of this article is to examine the research trends in Khon Kaen Agriculture Journal (KAJ). The objectives include identifying the number of published articles, determining the authors with the highest publication outputs, exploring the most frequent affiliation of the authors, and examining the issues that are prevalent in agriculture research.

2. Compilation of bibliometric data

Selection of research articles for analysis: The names of the articles published in Khon Kaen Agriculture Journal were retrieved from TCI-ThaiJo from 2013 to 2022. The selection was limited to only articles, of which 990 articles were selected (as shown in Table 1)

Table 1 Research articles published in Khon Kaen Agriculture Journal from 2013 to 2022

| Publication years	No. of research articles
2013	48
2014	56
2015	77
2016	72
2017	80
2018	119
2019	121
2020	126
2021	145
2022	146
Total	**990**

3. Bibliometric analysis

3.1 Performance analysis: This analysis focused on selecting appropriate data visualization with Looker Studio. First, suitable chart control options were chosen to display the data. The dimensions and metrics were selected, and various configurations were adjusted according to the requirements, as shown in Figure 1.
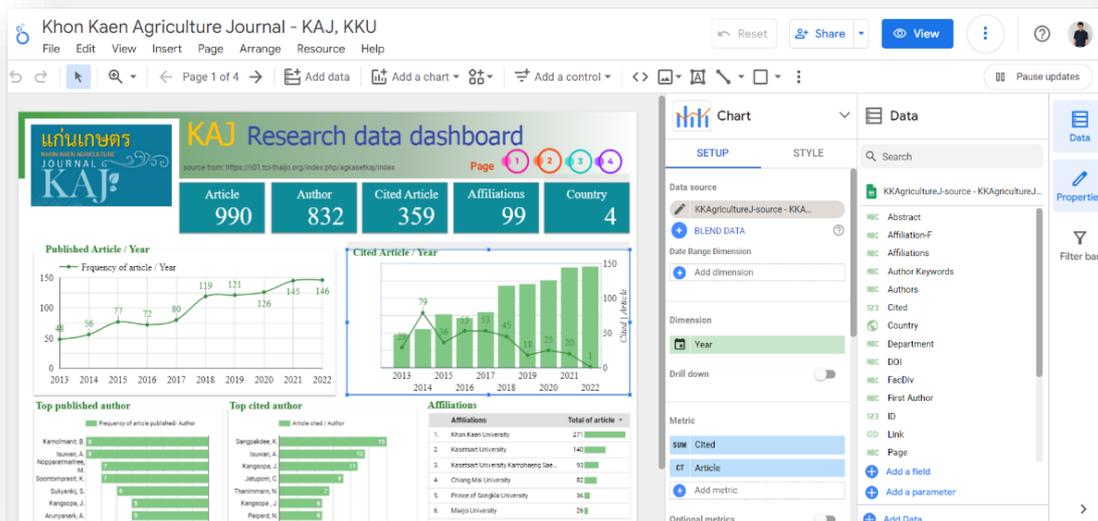
Figure 1. Research data visualization with Looker Studio

3.2 Visualizing scientific landscapes: The VOSviewer software was used to generate the keyword co-occurrence network, mapping clustering view, in the field of agriculture, as illustrated in Figure 2.
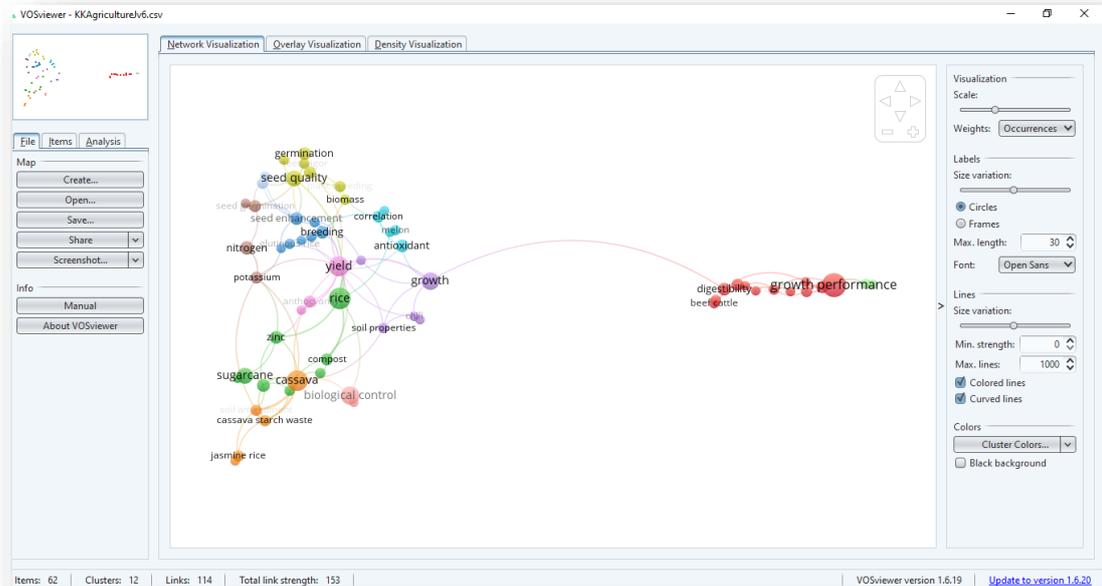
Figure 2. Scientific landscape visualization with VOSviewer

4. Visualization

The process of visualization representation analysis results through tables, diagrams, and graphs. This is accomplished through the application of tools such as VOSviewer (as shown in Figure 2) and Looker Studio (as shown in Figure 1).

5. Interpretation

After analyzing the data, the findings were presented with descriptive explanations and interpretations. The findings will present the researchers' proficiency, affiliation, countries, and highly cited research articles. Then keyword co-occurrence was employed to illustrate trends and research directions within the agricultural domain.

Results

1. Performance analysis

The analysis of research works related to Khon Kaen Agriculture Journal in the TCI-ThaiJo database from 2013 to 2022 can be summarized as follows (Figure 3).
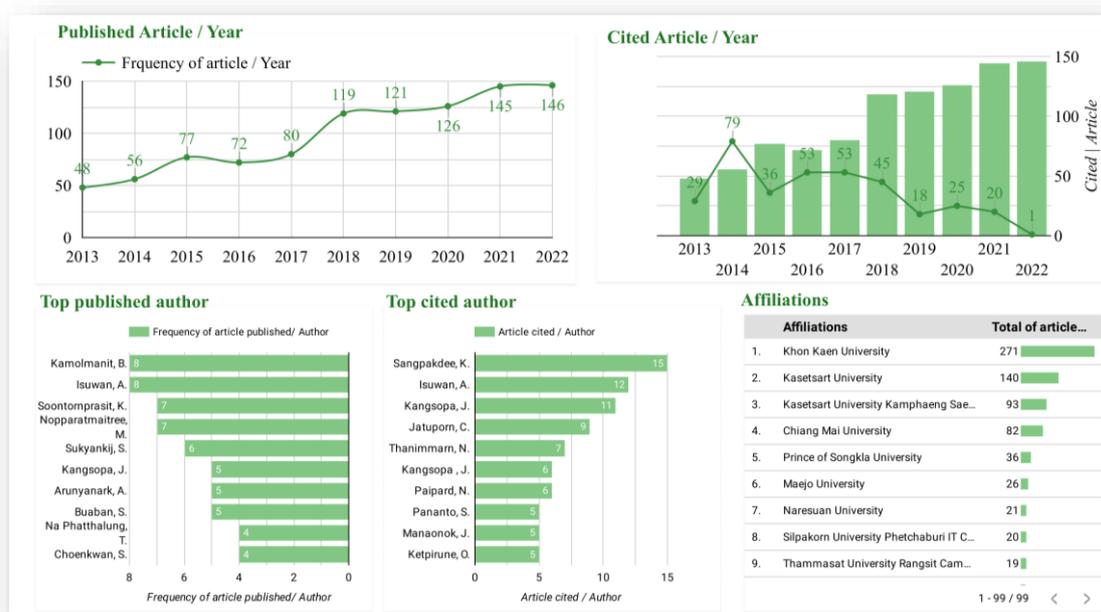
Figure 3. The research performance classified by published articles and cited articles from 2013 to 2022, top published authors, top cited authors and affiliations.

The 990 selected papers were published over a 10-year period spanning from 2013 to 2022. There was a consistent increasing trend in the number of articles each year, starting from 48 articles in 2013 and reaching 146 articles in 2022.

In terms of the citations, there were 359 citations. In 2014, there were 79 citations from 56 published articles, making it the year with the highest number of citations. In 2016 and 2017, there were 53 citations from 72 published articles and 80 articles respectively. There were 45 citations out of 119 articles published in 2018, and there were 77 articles published in 2015, and 36 articles were cited.

The five most productive authors in KAJ Journal are Kamolmanit, B. from Nakhon Ratchasima Rajabhat University (8 titles), Isuwan, A. from Silpakorn University Phetchaburi IT Campus (8 titles), Soontornprasit, K. from University of Phayao (7 titles), Nopparatmaitree, M. from Silpakorn University Phetchaburi IT Campus (7 titles), and Sukyankij, S. from Phranakhon Si Ayutthaya Rajabhat University (6 titles), and the top 10 authors altogether contributed 5.95% of all 990 papers considered in this review.

The five most cited authors are Sangpakdee, K. (15 citations) in 2014 from the article *"A study of chemical use behaviors of farmers in Ongkharak district, Nakhon Nayok province, Thailand"*. The article by Isuwan, A. (12 citations) was the most cited in 2016 (7 citations): *"The effects of site-specific fertilizer management on yield and fertilizer nitrogen use efficiency of Supanburi 1 rice grown on Wattana Soil Series"*. Kangsopa, J. (11 citations), in 2014 (10 citations) from the article: *"Effects of seed pelleting formulae on seed germination and vigor of tobacco seeds (Nicotiana tabacum L.)* and *Effects of binder substances developed for seed pelleting on quality of tobacco cv"*. Jatuporn, C. (9 citations) in 2016 from the article: *"Forecasting models for rubber production and export quantity of Thailand"* and Thanimmarn, N. (7 citations) in 2014 from the article: *Use of perlite, chicken manure and zinc foliar application for improving yields of cassava grown in Yasothon Soil.*

The authors' affiliations mostly are from 4 countries: Thailand (733), Laos (1), Bangladesh (1), and China (1). The most 5 affiliations that the authors submit for publication are as follows: Khon Kaen University (271), Kasetsart University (140), Kasetsart University Kamphaeng Saen campus (93), Chiang Mai University (82), and Prince of Songkla University (36). The authors from these universities are associated with departments in the field of agriculture. Other faculty, departments, or fields of study carry out research in agriculture, such as the Faculty of Economics, Kasetsart University, Institute of Biotechnology and Genetic Engineering Chulalongkorn University, and others. There are also some affiliations outside the university related to agriculture, such as the Highland Research and Development Institute (Public Organization), Khon Kaen Inland Fisheries Research and Development Center, and Betagro Co, Ltd. et al.

2. Visualizing scientific landscapes

VOSviewer software was utilized to create a clustering view of keyword co-occurrence for agriculture in Khon Kaen Agriculture Journal (KAJ). The co-occurrence analysis revealed 67 out of 2,969 words, and a total of 62 keywords were finally displayed.
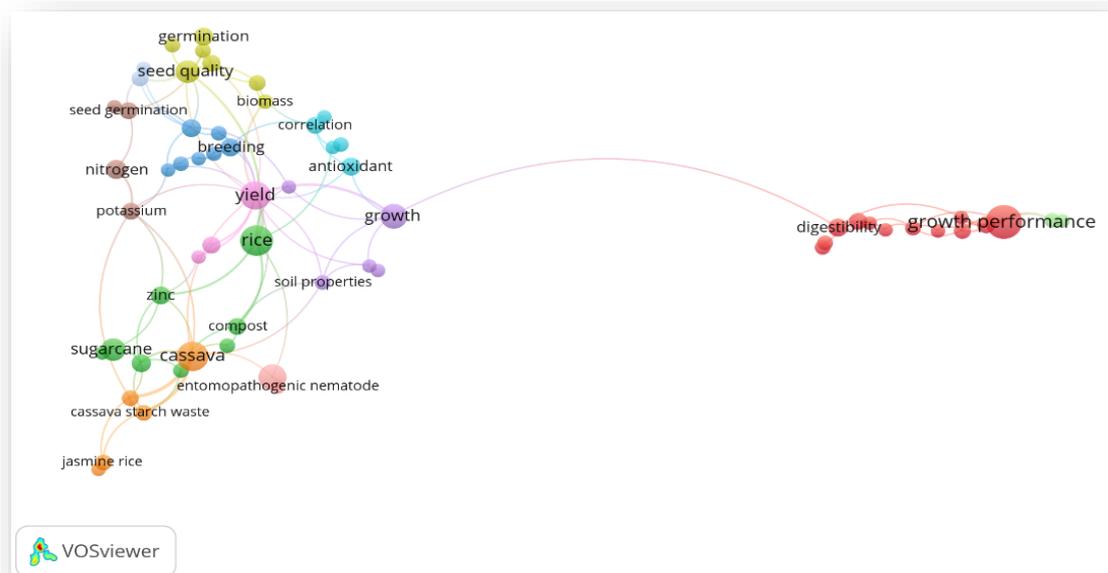
Figure 4. Keyword co-occurrences visualizing from VOSviewer

According to Figure 4, the size of the node and the font size are determined by the weight value of the keywords. The higher the weight value and the more frequently the keyword appears, the larger the node and font size. The line connecting nodes denotes that a keyword is shared with another keyword. The co-occurrence strength between the two keywords can be inferred from the thickness of the connection line. The co-occurrence strength is directly proportional to the thickness of the connection line, implying that a thicker connection line signifies a higher frequency of co-occurrence between the two keywords. The large-sized nodes depicted in the figure represent keywords that have high co-occurrence values, such as the nodes for "performance," "rice," "cassava," "yield," and "biological control." Additionally, the co-occurrence values for each keyword are displayed in Table 2. From the analysis shown in Figure 4, when utilizing the VOSviewer program's default values without

making any alterations, the topic can be divided into 12 clusters. Each cluster is accompanied by a summary of the corresponding issue, and the keywords for each cluster are presented in Table 2.

Table 2. Clusters and issue names

Clusters	Keyword co-occurrences	Issue names
1	beef cattle(6), broiler(7), broilers(8), carcass quality(8), cassava pulp(6), digestibility(9), growth performance(29), meat quality(5), performance(5), probiotic(6), productive performance(5), yeast(5)	Livestock production
2	biochar(6), chemical fertilizer(9), compost(8), farmer(5), participation(6), rice(24), sugarcane(13), zinc(9)	Sustainable agriculture
3	breeding(9), genetic diversity(6), glutinous rice(6), seed enhancement(9), selection(5), upland rice(6), yield components(5)	Food security
4	biomass(6), germination(9), maize(8), oil palm(6), plant breeding(7), seed quality(13), seed vigor(6)	Plant breeding
5	chili(5), electrical conductivity(5), growth(16), soil properties(6), wood vinegar(5)	Soil properties and by-products
6	antioxidant(9), correlation(8), drought(5), heritability(5), melon(6)	Plant genetics
7	cassava(22), cassava starch waste(7), jasmine rice(7), soil amendment(7), tropical soils(5)	Crop production
8	nitrogen(10), potassium(8), seed germination(8), soybean(5)	Soybean and seed production
9	anthocyanin(8), nitrogen fertilizer(5), yield(21)	Nitrogen fertilization
10	biological control(17), entomopathogenic nematode(5)	Biological control
11	heat stress(5), Thai native chicken(6)	Heat-tolerant animal development
12	seed pelleting(7), tobacco seed(5)	Modern seed technology

Table 2 displays the names of the issues acquired through the process of keyword co-occurrence. Three experts specializing in the agricultural field were engaged to evaluate and assign appropriate names to the issues, as well as to verify the accuracy of the issue names.

The size of a node representing the number of keyword co-occurrences is the central research area (shown in Figure 4) which is the most research trend. The most 5 issue researches and keywords in each issue are as follows: Cluster 1) Livestock production includes beef cattle, broiler, broilers, carcass quality, cassava pulp, digestibility, growth performance, meat quality, performance, probiotic, productive performance, and yeast; Cluster 2) Sustainable agriculture includes biochar, chemical fertilizer, compost, farmer, participation, rice, sugarcane, and zinc; Cluster 4) Plant breeding includes biomass, germination, maize, oil palm, plant breeding, seed quality, and seed vigour; Cluster 7) Crop production includes cassava, cassava starch waste, jasmine rice, soil amendment, and tropical soils; and Cluster 3) Food security includes breeding, genetic diversity, glutinous rice, seed enhancement, selection, and upland rice, and yield components. The other clusters are shown in the Table 2.

3. Data visualization

Fluently presenting research data through the application of Looker Studio is accomplished by utilizing conditions that allow for the selection of desired display options. These conditions include the ability to choose the year of publication, the cited article, the author, and more. Additionally, Looker Studio enables users to conveniently link to the desired article for further exploration (as shown in Figure 5).
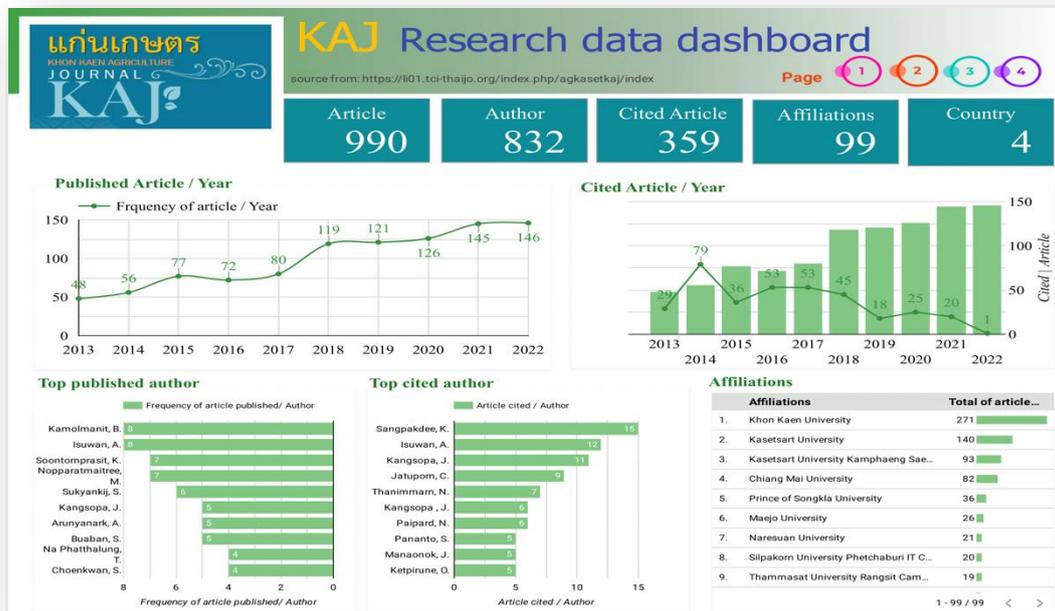

Figure 5. Research data visualization on Looker studio

Conclusion and Discussion

The number of published in the field of agriculture in Khon Kaen Agriculture Journal (KAJ) from 2013 to 2022 has been obviously increasing year by year. In 2014, the highest number of citations, totalling 79 citations from 56 articles. The author of these articles, Saengpakdee K., conducted a study titled "*Study of chemical use*

behaviour of farmers in Ongkharak District Nakhon Nayok Province, Thailand". This article has been cited in up to 15. There are two most productive authors, and 8 articles are published: Kamolmanit, B. from Nakhon Ratchasima Rajabhat University and Isuwan, A. from Silpakorn University Phetchaburi IT Campus. The authors' affiliations span four countries: Thailand, Laos, Bangladesh and China. Notably, Khon Kaen University was the highest representation among the affiliations contributing to the submitted publications. In addition to the university, some authors belong to other affiliations related to agriculture who published the articles.

The research trends in the field of agriculture in Khon Kaen Agriculture Journal (KAJ) are mainly Livestock production, Sustainable agriculture, Plant breeding, Crop production and Food security and other issue names. These issues show that agricultural studies related to increasing livestock and crop production for sustainable agriculture. It is a trend and related to the development of agriculture all over the world. The research data visualization makes it easier for those who need or wish to learn about agricultural research information. It was uncomplicated to access the listed information needed for comparing and monitoring research in the field of agriculture.

In comparison with research employed bibliometric methods to investigate the Journal of Agricultural Science, this study aligns with the research conducted by Mnzava and Chirwa (2019) and Thanuskodi (2012) commonalities exist to study in the examination of the number of articles, the contribution of authors and country of research. However, the present study does not focus on authorship patterns, citation analysis, or forms of the document. Instead, distinctive elements such as the examination of affiliations, countries, keyword co-occurrence clusters, and the assignment of a name to clusters were introduced by experts. This method aims to explain evolving research trends within the agricultural domain as documented in scholarly journals.

Bibliometric analysis is commonly performed by researchers using popular software and tools like VOSviewer, CiteSpace, Bibliometrix (Biblioshiny), BibExcel, Histcite, Gephi (Vargas et al., 2022) and Sci2, among others. The study utilized the VOSviewer software to analyze data because of its multifaceted capabilities in bibliometric analysis and its ease of use. VOSviewer offers a visualization mode, affording researchers the capability to visually assess and analyze the distribution and density of diverse research topics and keywords within scholarly documents (Abdelwahab et al, 2023). It helps identify clusters of keywords and authors, revealing trends and patterns in scientific publications (Uslu & Acikel, 2023). This research used the Looker studio to visualize the data. The objective of the Looker Studio was to investigate and demonstrate the data visualization capabilities inherent in a freely accessible, as well as web-based data visualization. Also, this tool can present data in an engaging and interactive format and facilitate timely user interaction with the dataset.

This paper is limited to the extensity of the literature and only performed a literature review on Khon Kaen Agriculture Journal (KAJ) publications' collection. In our future work, we propose to broaden the search scope by incorporating other renowned databases such as Scopus and ISI when executing a literature search, to achieve a more thorough understanding of the field.

References

Abdelwahab, S. I., Elhassan Taha, M. M., Moni, S. S. and Alsayegh, A. A. (2023). Bibliometric mapping of solid lipid nanoparticles research (2012-2022) using VOSviewer, *Medicine in Novel Technology and Devices*, 17, 100217. https://doi.org/10.1016/j.medntd.2023.100217.

Donthu. N., Kumar, S., Mukherjee, D., Pandey, N. and Lim, W. M. (2021). How to conduct a bibliometric analysis:An overview and guidelines. *Journal of Business Research*, 133, 285-296. https://doi.org/10.1016/j.jbusres.2021.04.070

Hoque, M. Akash, Mondal, S. and Adusumilli, S. (2022). Chapter eighteen - Way forward for sustainable livestock sector, in Mondal, S. and Singh, R. L. (Eds.), Emerging Issues in Climate Smart Livestock Production. Academic Press, 473-488. https://doi.org/10.1016/B978-0-12-822265-2.00016-8

Hu, Y., Yang, S., Qian, X., Li, Z., Fan, Y., Manevski, K., Chen, Y. and Gao,W. (2023). Bibliometric network analysis of crop yield gap research over the past three decades. *Agriculture,*13(11), 2105-2105. https://doi.org/10.3390/agriculture 13112105

Li, M. and Zhang, Y. (2022). A bibliometric and visualization review analysis of agricultural ecosystem services research. *Low Carbon Economy, 13*(01), 36-52. https://doi.org/10.4236/lce.2022.131003

Mao, G., Shi, T., Zhang, S., Crittenden, J., Guo, S. and Du, H. (2018). Bibliometric analysis of insights into soil remediation. *Journal of Soils and Sediments, 18*(7), 2520-2534. https://doi.org/10.1007/s11368-018-1932-4

Mnzava, E. and Chirwa, M. N. (2019). A bibliometric analysis of the Tanzania Journal of Agricultural Science (1998-2017). *Library Philosophy and Practice (e-journal)*. 2322.

Pan, X., Lv, J., Dyck, M. and He, H. (2021). Bibliometric analysis of soil nutrient research between 1992 and 2020. *Agriculture, 11*(3), 223-223. https://doi.org/ 10.3390/agriculture11030223

Sawangkul, S., Pinitpuwadol, W., Sakiyalak, D. and Choopong, P. (2020). Bibliometric differences between Scopus and Google Scholar for ophthalmology academics in Thailand: A comparative study. *The Thai Journal of Ophthalmology,* 34(1), 30-38. [In Thai]

Shah, S., M. (2016). A bibliometric analysis of international journal of agriculture sciences (2009-2014). *Asian Journal of Multidisciplinary Studies,* 4(2), 151-157.

Thanuskodi, S. (2012). Bibliometric analysis of Indian Journal of Agricultural Research. *International Journal of Information Dissemination and Technology*, 2(3), 170-175.

Umar, I. M., Mustafa, H., Lau, W. Y. and Sidek, S. (2022). Ninety-three years of agricultural accounting studies in Scopus journals: A bibliometric analysis from 1923 to 2020. *Journal of Accounting in Emerging Economies,* 12(5), 741-760. https://doi.org/10.1108/jaee-01-2021-0011

Uslu, T. U. and Acikel, B. (2023). Bibliometric analysis of academic publications on artificial intelligence and aviation keywords with VOSviewer.*Journal of Aviation*, 7(2), 284-292. https://doi.org/10.30518/jav.1293740

Vargas, A. C., Espinoza-Mina, M., Alvarez, D. L. and Espinosa, J. N. (2022). Bibliometric software: The most commonly used in research. *CEUR workshop proceedings, ICAIW 2022: Workshops at the 5th International Conference on Applied Informatics 2022,* October 27-29, 2022, Arequipa, Peru. 47-65.

Zhang, F., Liu, Y. and Zhang, Y. (2023). Bibliometric analysis of research trends in agricultural soil organic carbon mineralization from 2000 to 2022. *Agriculture,* 13(6), 1248-1248. https://doi.org/10.3390/agriculture13061248

Zupic, I. and Cater, T. (2015). Bibliometric methods in management and organization. *Organizational Research Methods journal,* 18(3), 429-472. https://doi.org/10.1177/1094428114562629