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Original Research Article

Walailak journal of science and technology - Scientometric and knowledge network analysis (2016-2021)

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ABSTRACT

Any flourishing scientific publication must emphasise on describing the structure of knowledge, the development of research themes, and the creation of new topics. Walailak Journal of Science and Technology, a Scopus-indexed top journal is making strides with an average of 180 articles published each year with multi-disciplinary spectrums. The whole objective of the study was to map out the knowledge clusters within the considered timeframe and to help the budding researchers to pick and explore the emerging themes. This study makes use of a bibliometric strategy and knowledge mapping, using CiteSpace and R Biblioshiny to conduct a quantitative and visual analysis of articles published between the years 2016 and 2021. In this particular research endeavour, evaluations concerning authorship, nations, institutions, reference articles, keywords, and reference journals were carried out. Through the review, a total of 626 articles with contributions of a total of 1955 writers were analysed. There is a 16.19% increase in the annual rate of scientific production. Food Chemistry journal is determined to be the most locally cited publication with 163 articles. MN Owaid, Tangpong J, and K Thammassiri have the highest H-Indexes, whereas the top authors are K Thammassiri and N Chuenboonngarm. The most important keywords are antioxidant, Covid-19, and antibacterial action. The highest contributing country is held by Thailand, which has an impressive 843 publications; in second place is Indonesia with 93 publications, and in third place is India with 78 publications. The coronavirus, thai fruits, cymbidium finlaysonianum, fat metabolite, and DNA sequence are the top 5 clusters with good Q and silhouette value.

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1. Introduction

The Walailak Journal of Science and Technology (WJST) is a peer-reviewed journal that features articles from a variety of fields but mainly sciences, including those of biological sciences, applied mathematics, engineering, physical sciences, agricultural technology, health sciences, information technology, and area-based research.¹ Since 2011, authors have been able to submit their papers online for consideration in this peer-reviewed journal, which is published by the Institute of Research and Development of Walailak University in Thailand.² Walailak Journal of

Science and Technology, also known as Trends in Sciences, is included in the databases of the Thai-Journal Citation Index Centre (TCI), Google Scholar, EBSCOhost, CAB Abstracts, Journal Seek, ASEAN Citation Index (ACI), and ROAD: the Directory of Open Access scholarly Resources. In addition, SCOPUS indexes Trends in Sciences or formerly WJST. The Walailak Journal of Science and Technology (WJST) is now known as Trends in Sciences (TiS).

Any scientific publication that has been successful with time has always put a substantial focus on defining the structure of existing knowledge, the growth of research subjects, and the formation of new subject areas. In the

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case of the Walailak Journal of Science and Technology, there is no thorough scientometric or bibliometric analysis done to map the clusters of knowledge. Earlier two studies were conducted for this journal within the time frame of 2004-2009 and 2010-2015 by Kosin Sirirak and Chitnarong Sirisathitkul.³ These studies were mainly focused on knowing the journal metrics, performance, journal evolution, subject categorization and productivity.⁴ To get the latest trend and evolution and not duplicate the previous work, we have to take the analysis year from 2016 to 2021.

The term "bibliometrics" did not come into use until the early 1900s. In 1969, it emerged as a standalone field of study,⁵ and by 2013,⁶ it was reported to be used extensively in literary criticism. According to Philipp Mayr & Andrea Scharnhorst,⁷ "Bibliometric analysis is a quantitative tool that may be used to examine and investigate the existing literature on a certain topic". According to the definitions provided by Cobo et al.,⁸ "Bibliometric research is an example of qualitative research that employs a large number of scholarly papers to learn about the evolution of study themes". Bibliometric mapping is research that falls under the umbrella of bibliometric studies and may be used in a variety of scientific research projects.

The approach that is used in this article is fruitful for several reasons, including the following: In the first place, it displays the network map of papers, authors, and nations which helps to track down the theoretical origins and evolution pattern of the topic. Second, the keyword research that we carry out is an iterative process that unfolds over time. To illustrate the changing nature of the connections between various subjects and themes through time, we constructed a cluster map that included a variety of colour schemes.⁸ It enables academicians to track changes in the research as well as spot possibilities to broaden the scope of their investigations. In conclusion, the map of cluster view makes it easier to locate critical places and major points by creating a full co-citations network and searching for important nodes based on the significant characteristics they exhibit. As an outcome, the purpose of this work is to close the knowledge gap and provide a transparent perspective based on bibliometric and graphical analysis.

This article starts with a synopsis of a bibliometric/scientometric study that was conducted on WJST. The CiteSpace and Biblioshiny programme, its accompanying settings, and every detail about the data sources are then shown. After that, the findings and discussions of analysed papers (that is, papers searched for this research) and cited papers (that is, references of papers sought for this study) are exhibited and examined. In the end, we will summarise the most important discoveries and contributions made throughout this study, as well as identify any possible limits. This article has certain objectives that it will attempt to provide answers to the following:

1. *Objective 1:* What kinds of insights and bibliometric data are available to us via the examination of collected papers from WJST Journal in the time frame of 2016-2021?
2. *Objective 2:* What new information and themes are available to us by analysing the papers that have been cited?
3. *Objective 3:* Which authors, countries/regions, institutions and keywords have been most impactful?

2. Materials and Methods

After locating and choosing an acceptable database, the necessary data were retrieved to continue with this investigation. Figure 1 clearly explains the process logically. In the beginning, a descriptive analysis of the data is carried out, focusing on the sources, documents, and authors involved. After that, the data were reduced using methods like principal component analysis and multiple correspondence analyses, among other methods. After this, network maps were drawn up so that the data could be shown more clearly, so showing the conceptual, intellectual, and social patterns hidden within the data.⁹ Data retrieval is done from Scopus, which was developed by the Elsevier BV Company in the United States. Since WJST is indexed in Scopus and its database is compatible with Bibliometric software by R-studio, data retrieval is done from Scopus.¹⁰

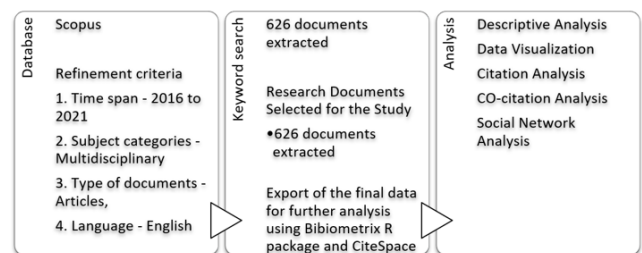


Fig. 1: Flowchart of the process involved in Bibliometric/scientometric analysis

The advanced query string for retrieving Bibtext and RIS files were as follows: SOURCE-ID (21100258402) AND (LIMIT-TO (PUBYEAR, 2021) OR LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR, 2019) OR LIMIT-TO (PUBYEAR, 2018) OR LIMIT-TO (PUBYEAR, 2017) OR LIMIT-TO (PUBYEAR, 2016)) AND (LIMIT-TO (DOCTYPE, "ar"))

All papers that were published between the years 2016 and 2021 were included in the data set, with the primary goal being to identify the most recent tendencies and viewpoints in the WJST. At this step, there were a total of 626 items extracted. After the data have been collected, the findings will be subjected to filtering. The highlighted list was combed through, and 626 papers were chosen to be exported in the Bibtext and RIS file formats.

2.1. Software Selection and Analysis

There are a variety of statistical software programmes, such as SciMAT (2011),¹¹ Bib Excel,¹² Cite Space (2004),¹³ HistCite (2004), and that have simplified the process of conducting bibliometric research. Biblioshiny was utilized for typical basic scientometric analysis because it shows aesthetically beautiful graphs and figures. However, we continue to use CiteSpace for network mapping because it has its own unique patented algorithms.

Biblioshiny for bibliometrix is a Java-based programme that was built to conduct functional combination research utilizing the bibliometrix package with web applications that were utilized in the shiny package setting in R Studio.¹⁴ This method of scientometric analysis combines tools for performance analysis with mapping tools from the field of bibliometrics to investigate research fields, the generalization and visualisation of conceptual subdomains, and the development of thematic evolution on a specific research topic.¹⁵ The use of R Bibliometrix brought the discovery of datasets as the outcomes (main information, annual scientific production and three-field plots). The most recent version of the Biblioshiny package for the R statistical programming language was installed in RStudio (version 4.2.0) and was used for the analysis.

CiteSpace is an analytical software that was created by Chaomei Chen at Drexel University.¹³ It is founded on the Java programming language and outputs tabular data as well as graphic maps. CiteSpace is useful for locating pivotal points and major points because of its ability to combine co-citation and visual maps. This is accomplished by producing parted co-citations, forming a whole cocitations network, and seeking key nodes with their respective striking characteristics.¹⁶ In summary, CiteSpace can locate rapidly expanding themes by determining burst words, cluster various analytic nodes according to type, and automatically label clusters with keywords, therefore identifying the authors and organizations that collaborated on the work.¹⁷ CiteSpace research shows that a node with such high centrality connects two or more groups and shows a transition pattern. In figures, nodes represent analytic items (author, journal, reference, etc.) and their magnitude shows their cumulative co-occurrence frequency. This study uses cluster and time zone network analysis. A cluster view shows knowledge advancement and node relationships. The time zone display showed WJST's focus on subject progression at a given timeframe (2016–2021). This research uses CiteSpace Version 6.1.R3, which has two new features: year-by-year topic clustering label analysis and dual-map overlay journal analysis.

3. Results and Discussion

3.1. Main Information and annual scientific production

The primary goal of every scientometric study is to isolate and describe the most important aspects of dataset.¹⁸ Publications in this journal span the years 2016 to 2021. There are, on average, 125.2 papers published each year (As this is a semimonthly journal the output rate is very high). Considering that the average number of citations per document is 1.812, it is safe to assume that these sources are well-respected enough for a semimonthly journal and considering the recent timespan. There are a total of 1955 authors, 2208 author appearances, 55 single-authored authors, and 1900 authors who contributed to several articles under the WJST. The "Documents per Author" is 0.32 and the "Collaboration Index" is 3.33. This journal is a multidisciplinary subjects journal and a "Collaboration Index" of 3.33 is a good indicator of it. The Annual Scientific Production growth rate is 16.19%.

3.2. Three-Fields plot

Sankey Plots (Figure 2) show the relationship between three fields, where the size of a section is proportional to the node's value. To the left of the Sankey Plot are the References used, in the centre are the authors, and to the right are keywords. In this study, we model the relationships between the three components of the domains of authorship, References and keywords. The acclimatization keyword is used by these authors K Thammasiri, S Klaocheed and S Rittirat belonging to biological sciences and they are mostly referring to this article of T Murashige revised medium for rapid growth and bioassays with tobacco tissue cultures. The antioxidant and its activity keyword are also major keywords in many works.

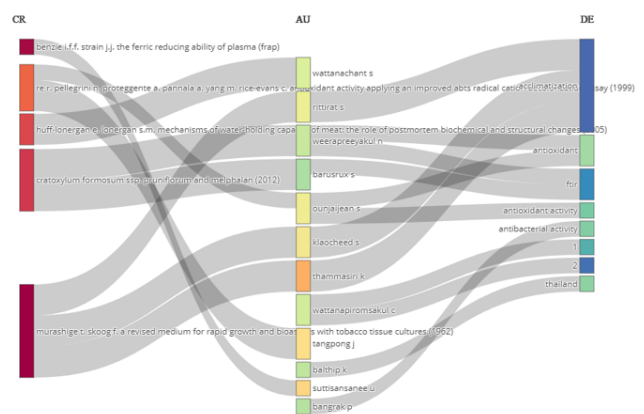


Fig. 2: Three fields plot by references -Author-keywords

3.3. Most local cited sources

Food Chemistry journal of Elsevier is the highest local cited with 163 articles cited. Second, on the list is PLOS ONE with 87 articles citations (Figure 3). Then we have two clusters of average citations of 55-65 and 30-40 with many journals. The top two stands out and many local citations of Food chemistry and engineering.

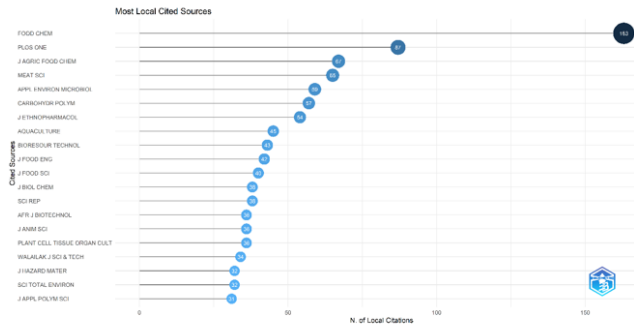


Fig. 3: Most local cited sources

3.4. Authors' production over time and their impact

Figure 4 shows the top writers in time period of 2016–2021 output. The red line displays the author's production from the start of his career to the year of his last scholarly article. Bonus: a red circle shows the year's paper distribution. The image below lists WJST writers. K Thammasiri, a biological science expert, wrote more from 2016 to 2021. N Chuenboongarm ranks second. The h-Index ranks published authors by influence. 0–15, the writer's h-Index. MN Owaid, Tangpong J, and K Thammasiri have the highest h-Index.

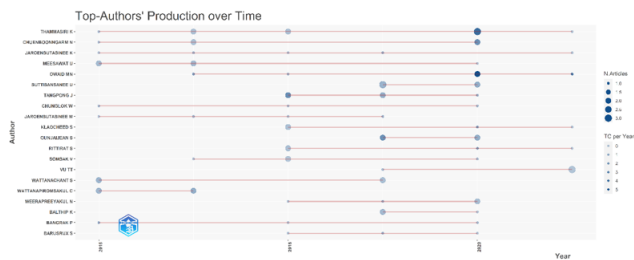


Fig. 4: Authors' production over time

3.5. Affiliation statistics

Prince of Songkla University has published 134 documents in the WJST, followed by Walailak University and Mahidol University. Commenting on Figure 5, the colour intensity is proportional to the number of publications. That is, the countries with the darker colour are the most contributing

countries. In the first place, Thailand stands with massive 843 publications, second on the list is Indonesia with 93 publications and India stands third with 78 publications.

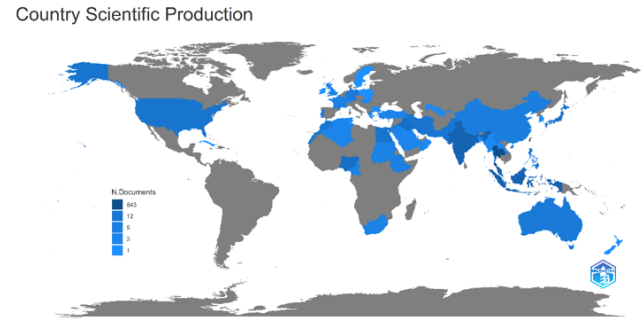


Fig. 5: Country scientific production

3.6. Keywords statistics and thematic map of WJST

The Word TreeMap in Biblioshiny displays words that often appear in boxes similar to regions on the map, where the more words appear, the larger the square area. A list of unnecessary keywords was removed by using a “Load a list of terms to remove” feature. Antioxidant, Covid-19, and Antibacterial activity are the top keywords. By applying a clustering technique to the network of keywords, we can generate a thematic map that depicts the many topics covered by our journal. Ten distinct groups are shown in the plot in Figure 6. Antioxidant is the highest frequent word that serves as the bubbles' name. If a term is used often, the bubble will be larger. Each bubble's location is determined by the cluster's centrality and density. While "density" may be thought of as a measure of how far along the topic is in its evolution, "option centrality" describes how significant the theme is within the whole field. Covid-19 and antibacterial activity are two of the most prominent trends.

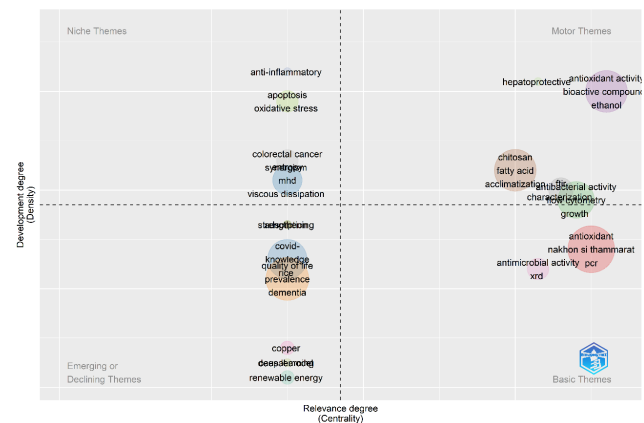


Fig. 6: Thematic map of WJST

In emerging cases, newer, more popular topics have evolved from older, more established ones; for example, the topic of dementia developed as a reaction to the longer-established topic of Covid. Terms like "apoptosis," "oxidative stress," and "viscous dissipation" in this study demonstrate that you're doing a hyper-specialized version of fundamental research.

3.7. Intellectual structure and co-citation analysis

The nodes in the intellectual structure represent references, and the connections between those nodes are shown in Figure 7 which highlights the intellectual structure's references and their linkages. Graph theory-based co-citation network analysis studies reference pairings (Figure 7). "Biblioshiny app" builds the co-citation network. Figure 11 shows the network creating three clusters. The main benefit of choosing articles from a co-citation network is learning about the most cited researchers. Clusters constitute the network's figure. The larger authors' names reflect pioneering work, and the deeper colours denote the structure's three components. The red cluster includes Wang, Chen, and Liu's most cited papers. Zhang, Kumar, and Singh lead the blue cluster.

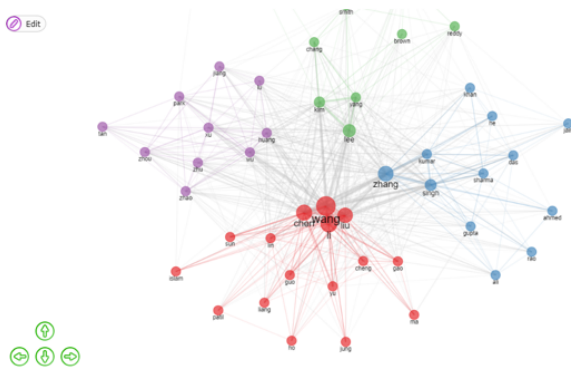


Fig. 7: Co-citation network

3.8. Collaboration and social structure analysis

The topology of the network identifies the creation of nine separate clusters quite clearly. The fundamental advantage of a cooperation network is that it delivers information on the scientists who are most frequently collaborating with others. Figure 8 depicts Thammasiri k as collaborating the most in cluster 1 with other authors like chuenboongnarm n and others. The second and third prominent clusters are led by kulprachakarn and srichairatanakool.

3.9. Knowledge clustering and mapping

The primary ideas discussed in a body of scholarly work are encapsulated in the form of keywords. This study



Fig. 8: Authors cooperation network

depicts the primary emphasis on the development trend in WJST. CiteSpace provides this facility by co-occurrence analysis of the keywords, authors and cited sources that are used in the WJST. To begin, the programme was configured using the term "Node Type" as the value of the parameter "Node Type," and the time slice "#Years Per Slice" was set to 1. G-index with a scale factor $k=25$ was chosen as the new value for the threshold of "Selection Criteria" for each time slice, and Pathfinder+Pruning sliced networks were the method of choice for cutting the networks. There was a Merged network of 292 nodes, and links were of 567 numbers after applying the Find clusters tool in the software for the keyword, authors and cited sources, a total of 15 clusters was formed as seen in Figure 9. The Modularity $Q=0.0848$ in Figure 9 and Figure 11 indicates good clustering and the Mean Silhouette coefficient $=0.9$, indicates a general and good Silhouette of the network, which gives strong credibility to this network. The phenomenon of any keyword's emergence repeatedly within a certain period is represented by the term "burst keyword." This data may reveal how research hotspots have changed over time, highlight current research trends, and perhaps provide clues about the future of the field. In Figure 10 nine keywords are shown from the bursts that were found in this analysis. The top-ranked item by bursts is MURASHIGE T (2017)¹⁹ in Cluster 2, with bursts of 2.82.

Applying the year-by-year cluster function of Cite Space, we created a timeline map (Figure 11) of the cluster of keywords and authors, year by year, to show where the evolution of research themes began. The latest version of CiteSpace includes a feature that generates labels of a cluster year by year based on phrases found by latent semantic indexing.²⁰ The seven most prominent clusters are the primary targets of this study. Table 1 highlights major clusters first, including citing articles and cited references. The importance of nodes will be summarized in terms of citation-based metrics such as citation counts and citation bursts, and network-based metrics such as degree centrality and betweenness centrality. Sigma is a combination of both

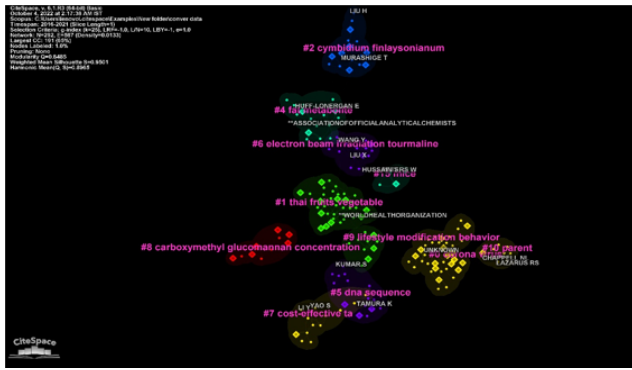


Fig. 9: Knowledge clusters of WJST in 2016-2021

Top 9 Authors with the Strongest Citation Bursts

Authors	Year	Strength	Begin	End	2016 - 2021
XU Y	2016	1.44	2016	2017	
MURASHIGE T	2016	2.82	2017	2018	
**ASSOCIATIONOFOFFICIALANALYTICALCHEMISTS	2016	1.89	2018	2019	
ZHANG Y	2016	1.89	2018	2019	
LEE S	2016	1.51	2018	2019	
ELLMAN GL	2016	1.51	2018	2019	
antioxidant	2016	1.17	2018	2021	
depression	2016	1.66	2019	2021	
quality of life	2016	1.32	2019	2021	

Fig. 10: Authors with strong citation bursts

types, i.e., burst and betweenness centrality.²¹ The largest cluster (#0) has 39 members and a silhouette value of 0.961. The major citing article of the cluster is: “SINGKUN, A (2020.0) Social responsibility behaviour among universities students in the 3 southern border provinces of Thailand in the period of coronavirus 2019 (covid-19) pandemic. *Walailak Journal of Science and Technology*, V17, P11”.²² Coronavirus cluster also involves “prevalence elderly” and “urbanization” as other key nodes. The second largest cluster (#1) has 37 members and a silhouette value of 0.878. It is labelled as thai fruit vegetable by LLR, other phytochemical properties by LSI, and pregnant teenager (1.09) by MI. The major citing article of the cluster is: “NANASOMBAT, S (2019.0) Evaluation of antidiabetic, antioxidant and other phytochemical properties of thai fruits, vegetables and some local food plants. *Walailak Journal of Science and Technology*, V16, P16”.²³ Thai fruits vegetable also involves “quality of life” and “health risk assessment” as other key nodes, more key nodes can be studied from Figure 11. The third largest cluster (2) has 19 members and a silhouette value of 0.954. It is labelled as cymbidium finlaysonianum by both LLR and LSI, and as spathoglottis eburnea gagnep (0.19) by MI. The major citing article of the cluster is: “RITTIRAT, S (2018.0) In vitro propagation and forest reestablishment of cymbidium finlaysonianum lindl., an endangered medicinal

orchid. *Walailak Journal of Science and Technology*, V15, P14”.²⁴

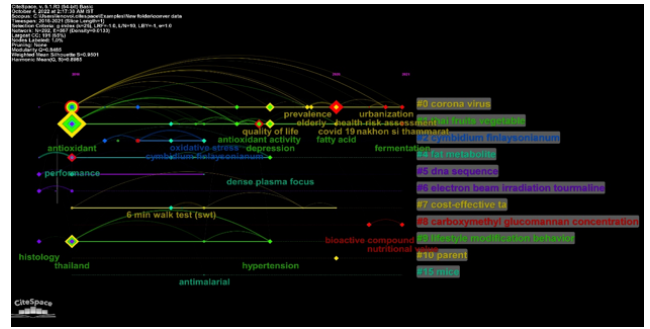


Fig. 11: Timeline view of research topics year by year

4. Conclusions

CiteSpace and Biblioshiny visualised Walailak Publication of Science and Technology (WJST), a peer-reviewed journal, from 2016-2021. The main findings from 626 articles and 18827 reference papers are: 125, 2 articles are published annually (as this is a semimonthly journal the output rate is very high). 1955 writers—55 single-authored and 1900 multi-authored—have 2208 author appearances in the WJST. Scientific productivity increased by 16.19% annually. 2021 had the most average citations per paper, with 0.794 per year. WJST analyses most locally cited sources, and Elsevier’s Food Chemistry journal has 163 articles. Thailand leads the source country list with 843 publications, followed by Indonesia with 93 and India with 78. Authors can measure their work’s influence using the h-Index. Despite having the highest h-Indexes, K Thammasiri and N Chuenboonngarm are not the most influential writers. K Thammasiri and N Chuenboonngarm are top authors. The Word Tree Globe displays frequently occurring words in boxes that resemble map areas, where the square area is proportional to the number of times the word appears and grows as the number of words increases. Antioxidant, Covid-19, and antimicrobial are significant terms. Graph theory allows co-citation network analysis of reference pairings. The intellectual structure shows references and their connections. The cluster of the most-mentioned works, including Wang, Chen, and Liu, is shown. Zhang, kumar, and singh lead the blue cluster. Dark blue symbolises Thailand’s leadership and cooperation with Japan, Indonesia, the US, Australia, and others. Here is CiteSpace’s study of the WJST’s keyword, authorship, and cited source usage. Bursts are periods when one or more keywords appear often. MURASHIGE T (2017)¹⁹ in Cluster 2 ranks highest in bursts with 2.82. CiteSpace’s year-by-year cluster algorithm created a timeline map of keywords and authors. This map showed where research topics began. The top five clusters are coronavirus, Thai

Table 1: Summary of the 11 knowledge clusters in WJST (2016-2021)

ClusterID	Size	Silhouette	Label (LSI)	Label (LLR)	Label (MI)	Average Year
0	39	0.961	Social responsibility behavior	Corona virus (25.01, 1.0E-4)	Waste management (2.68)	2019
1	37	0.878	Other phytochemical properties	Thai fruits vegetable (35.37, 1.0E-4)	Pregnant teenager (1.09)	2018
2	19	0.954	Cymbidium finlaysonianum	Cymbidium finlaysonianum (52.12, 1.0E-4)	Spathoglottis eburnea gagnep (0.19)	2017
4	17	0.986	Fat metabolite	Dat metabolite (37.45, 1.0E-4)	Fried battered product (0.07)	2017
5	17	0.98	Nuclear gene	Dna sequence (39.2, 1.0E-4)	Slender walking catfish (0.21)	2016

fruits vegetable, cymbidium finlaysonianum fat metabolite, and DNA sequence. The largest cluster, number 0, has 39 members and a silhouette value of 0.961. LLR called it the Corona virus, LSI social responsibility, and MI waste management 2.68.

5. Source of Funding

None

6. Conflict of Interest

None.


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