

Research Trends of Visvesvaraya Technological University (VTU) as Reflected in Web of Science Database: A Bibliometric Analysis Using Biblioshiny Software

Ambika C.A¹, Nagajyothi H.K²

¹Librarian, Library & Information Centre, K.S. School of Engineering and Management, Bengaluru

²Librarian, Library & Information Centre, Global Academy of Technology, Bengaluru

ABSTRACT

VTU is a vast technological university in Belgaum offering engineering and technical education. The paper aims to present a bibliometric analysis of the publication output of VTU from 2014 to 2023 that are mapped in Web of Science database. Data for the study was collected from Clarivate's web of science, a bibliometric and widely used database. Biblioshiny software was used for analyzing research trends, types of publications, average citations per article and year, most prolific authors, trending topics of research and sources of publications. Findings revealed that authors preferred to publish more in journals. Publications were high in the year 2021. Mean citations per article and per year was high in 2019. Word cloud reveals the trending topics of research. This will help the present researchers to know the state of the research. Maximum occurrence of the word 'Performance' was the most trending topic of research. Maximum number of publications were made in Material Today Proceedings. Afzal was the most prominent author with 170 publications. The present study provides the current status of research of VTU as mapped in web of science database and helps the policy makers to foresee the future of research.

KEYWORDS: Publication Analysis, Citation Analysis, Word Cloud

INTRODUCTION

Academic institutions are promoting research culture among its faculties to discover new knowledge. Research is the nucleus function and should be evaluated regularly (Gangadhar & Nagaraja, 2020). Research productivity in the form of articles or project proposals is highly essential in higher educational institutions (M, 2022). Publication metrics is the yardstick to measure the state of the research of any institution. Performance of the institutions are measured using research publications in peer reviewed journals (Das, 2002). Bibliometrics is a statistical method to analyze publication in an adequate way (Gomez & Rosselli, 2021). Bibliometric analysis provides overall structure of research areas by covering quantity, quality and structural indicator in the areas of research (Radha & Arumugam, 2021). Professional institutes are producing scientific and technical knowledge. Journals are the popular source to spread this new knowledge (D'Souza, 2021). The study aims to provide state of the art report of VTU as reflected in WOS database. This helps in understanding the position of VTU in research. Science

mapping is vital activity for scholars across all disciplines(Aria & Cuccurullo, 2017). Bibliometrics is suitable for science mapping and an efficient means to quantify the published work by analyzing data into numerical figures(Mokhtari et al., 2019). It is a tool used to identify, collate, measure and analyse the research output(Kumar et al., 2015). It is significant in identifying gaps and trends in scientific literature(Odoi-Yorke et al., 2024). Evaluating the research output highlights the contribution of an individual and institution engaged in research(Kademani et al., 2005). Web of science is the best standard index to indicate the research output across different subjects. Implementation of National Institutional Ranking Framework (NIRF) is prioritizing to publish more in journals and conferences that are indexed in scopus or web of science databases(M, 2022).

VISVESVARAYA TECHNOLOGICAL UNIVERSITY:

VTU established in Belgaum is one of the largest technological university for engineering and technical education in Karnataka with 24 years of tradition of excellence in engineering and technical education, research and innovations. It is comprised of a multi-disciplinary and multi-level institution offering varied programmes in engineering, technology and management. At present, it is having 182 affiliated colleges, 1 constituent college and 25 autonomous colleges with under graduated programs in 37 disciplines, PG programs in 96 disciplines and Ph.D. and M.Sc (Engg.) research programs with 7 faculty, over 3 lakhs engineering students study in the various institutes affiliated to it (<https://vtu.ac.in/about-vtu/>).

REVIEW OF LITERATURE:

Bibliometrics is a descriptive tool that reports account of publication details at countries, provinces, cities or institution levels used for comparative analyses(Gauthier, 1998). It is a method of evaluating scientific publications from different perspectives(Mokhtari et al., 2019). Few studies analysed on topics such as artificial intelligence(Fitriani, 2023) machine learning(Su et al., 2021) skiing(Hou, 2024) cycle power plants(Elwardany, 2024) and heritage buildings(Mohamed & Marzouk, 2023). Few analyzed journals such as Journal of knowledge management(Gaviria-Marin et al., 2018) European journal of marketing(Martínez-López, 2018) and Journal of documentation(Mokhtari, 2020). Few studies covered institutes and universities as follows:

Zhu et. al. (2014) analyzed the research output of Chinese universities and found that they have reached world class levels in the fields of engineering and chemistry when compared to American and European universities with regard to publications and citations.

In 2015, Kumar et. al. evaluated Gujarat university and found that it was far behind Madras and Mysore university when compared with its publications. They suggested to develop research-friendly environment to promote research, recognition to authors with incentives and organizing workshops can improve research culture in its university.

Nagaraja, A and et. al. (2017) analysed research output of engineering colleges in Karnataka. Publications affiliated to VTU were extracted from web of science database covering the period 1989 to 2015 and processed using MS Excel. Study reported authors preferred to publish their research as articles and there was an elevation in document publication from 2004 onwards. Aided and private institutions topped in the research output.

Gangadhar and Nagaraja (2020) analysed publications of VTU affiliated engineering colleges in Karnataka covered in scopus database. Their study found maximum no. of 12,062 research work were published as conference papers compared with other forms. Authors preferred to publish in Materials

Today Proceedings of Elsevier which is a commercial type. Majority of the publications were in the fields of computer science compared to other areas. They suggested scholarships, stipend and grants can be encouraging in improving lagging areas.

Bhadrashetty (2021) analysed the publications of VTU indexed in scopus database covering the period 2012 to 2021. Analysis of 2050 publications revealed that papers published in 2021 were twenty two times greater than 2012. Maximum publications were in the field of engineering and computer science stream. In 2021, Bachalapur and Hugar studied publication trends of BLDEA's college of engineering and technology indexed in scopus database. They focussed on measuring research production and citations during 2001 to 2019. The study observed the mean relative growth of publications was higher in the first decade of study. The prolific author belonged to the Chemistry department received 509 citations. Chemistry department topped in aspects of publications, citations and h-index. Researchers of BLDEA published more in Communications in computer and information science more when compared with other journals. Authors suggested the librarian to take initiative in promoting open access publications that impacts in getting more citations.

Dsouza (2021) examined research publications of St. Joseph Engineering College. The study revealed that Mechanical engineering department was the top department that had received 1518 citations. Authors preferred to publish their research work in Journal of Molecular Structure. Incentives were given to the faculties publishing in high impact journals and financial support was given for presenting papers in conferences. These policies promoted faculties to publish more in scopus indexed journals.

Gomez-Roselli and Rosselli (2021) were of the opinion that growth in publications was due to investments from the public and private universities that placed Colombia as a benchmark of research in Latin America and 53rd place in worldwide benchmark.

Mandhirasalam (2022) analyzed the research output of engineering colleges in Coimbatore from 2017 to 2021 and reported that there was a uniform trend in the annual output of all the five colleges under study. Few colleges published more in conference proceedings, there was a steady increase in publication output in 2020. Obtaining higher rank in NIRF and good grades in NAAC and NBA promoted the authors to publish more in scopus indexed journals and proceedings. They suggested that the focus on increasing the research output should not deteriorate the quality of research.

Evaluation of scientific publications helps in identifying the strengths and weakness of publications and helps decision-makers in overcoming the possible gaps.

After reviewing various literature, it was found that none of the studies analysed VTU publications as reflected in Web of Science database. Few studies conducted bibliometric analysis of scopus database. Hence, the present study aimed at fulfilling the gap.

OBJECTIVES OF THE STUDY:

1. The main objectives of the paper are to:
 1. Analyse research trends of VTU from 2014 to 2023.
 2. Examine the type of documents published and its annual scientific growth.
 3. Analyse average citations per article and per year.
 4. Identify most prolific authors.
 5. Identify the trending topics of research.
 6. Identify the most relevant sources of publication.

METHODOLOGY:

Data Collection:

Web of science and scopus furnish reliable data of research publications pertaining to scholarly publications(Tran & Aytac, 2016). Present study explored web of science (WOS) database for bibliometric analysis in July 2024 by using affiliation term “Visvesvaraya Technological University” for the final publication year 2014 to 2023.

A total of 3098 records were retrieved from the database. It was noticed that 8 papers were retracted. Hence, they were omitted from the study and later the search yielded 3090 publications. All types of documents except retracted publications were considered for further analysis. Since, biblioshiny software supports .txt files for analysing data from web of science, records were downloaded in the same format for further analysis. Bibliometric R package version 4.3.2 was installed and R studio for windows version was downloaded. Commands like `install.pacakages(“bibliometrics”)` followed by `library(bibliometrix)` and `biblioshiny()` were used to install biblioshiny software. <http://127.0.0.1:4188> was used for analysing data. Raw file was imported in biblioshiny for analysis.

ANALYSIS AND INTERPRETATION:

Results obtained from the analysis are discussed in this section. Table1 and fig 1 provides the detailed information of the analysis. Three thousand and ninety documents were published in 1117 web of science indexed journals, books, proceedings etc in a decade i.e. in the time span of 2014 to 2023 by 6017 authors with an annual growth rate of 19.54%, average citations per document is 12.01 and total references used were 90495. Author keywords were 9586. Only 25 were sole authored documents that shows authors preferred to work with collaboration.

Table.1 Information Abstract of VTU Publications

Description	Results
Timespan	2014:2023
Sources (Journals, Books, etc)	1117
Documents	3090
Annual Growth Rate %	19.54
Document Average Age	4.37
Average citations per doc	12.01
References	90495
DOCUMENT CONTENTS	
Keywords Plus (ID)	4578
Author's Keywords (DE)	9586
AUTHORS	
Authors	6017
Authors of single-authored docs	25
AUTHORS COLLABORATION	
Single-authored docs	28
Co-Authors per Doc	4.25

International co-authorships %	19.9
DOCUMENT TYPES	
article	2007
article; data paper	2
article; proceedings paper	9
biographical-item	1
correction	11
editorial material	4
letter	2
meeting abstract	2
proceedings paper	955
review	96
review; book chapter	1

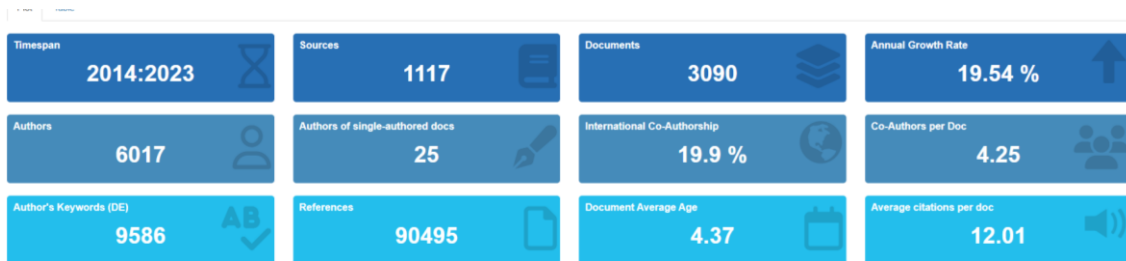


Fig.1 Information Abstract of VTU Publications

Fig.2 shows type of documents published by VTU during 2014 to 2023 included 2007 articles, 2 data papers, 9 proceedings paper, 1 biographical item, 11 corrections, 4 editorial materials, 2 letters, 2 meeting abstracts, 955 conference proceedings papers, 96 reviews and 1 book chapter review.

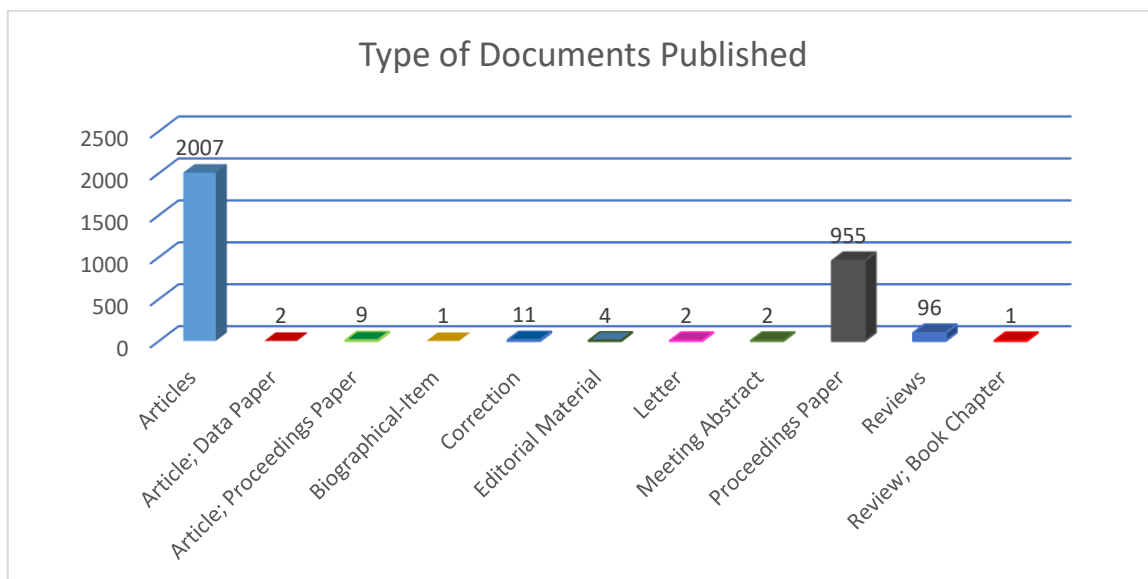


Fig.2 Type of documents published by VTU

Annual scientific output of engineering colleges affiliated to VTU covered in WOS database is depicted in fig.3. It provides the spectroscopy of publications. Analysis shows that there was an increase in publication every year from 2014 to 2017, it can be noticed that there a decline thereafter. From 2019 to 2021 the publications increased gradually. In 2021 publications were at peak (n=545). Later from 2022 onwards there was a decline in the publications, it reduced to 359 in 2023. This indicates that highest no. of documents were produced in 2021. Fig.1 shows average publication growth per annum was 19.54% during 2014 to 2023. Though, publications has multiplied by 5 times from 2014 to 2023, the curve shows increase in publications was not always the constant.

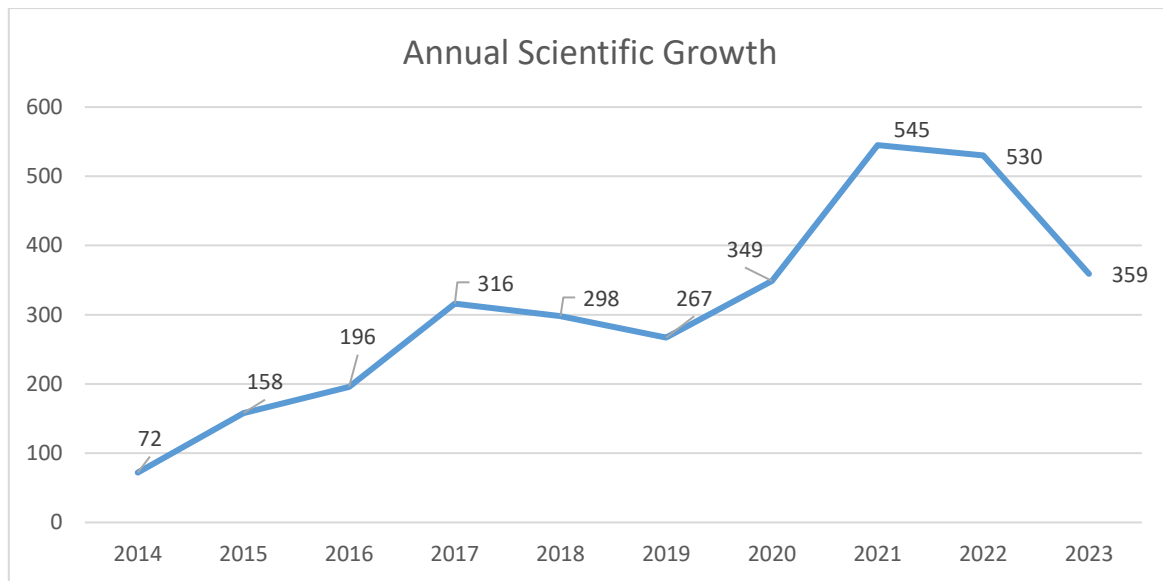


Fig.3 Annual Scientific Growth

Bibliometric analysis helped in getting the spectroscopy of average citation analysis of both on an average per article and per year. Fig.1 shows average citation per document is 12.01%. Table 2 depicts mean citation per article and per year. Though there was highest publications in 2021, n= 545, highest citation per article was in 2019 with an average of 27.01 and the same year witnessed highest citation 4.50.

Table 2 Mean Citations Per Article and Per Year

Year	MeanTCperArt	N	MeanTCperYear	CitableYears
2014	10.24	72	0.93	11
2015	8.70	158	0.87	10
2016	10.42	196	1.16	9
2017	10.63	316	1.33	8
2018	15.57	298	2.22	7
2019	27.01	267	4.50	6
2020	17.39	349	3.48	5
2021	11.39	545	2.85	4
2022	8.09	530	2.70	3
2023	3.29	359	1.65	2

Three field plot represents network between the authors, source of publication and the keywords used. While extracting data number of items were fixed to 20.

The relationship between three elements: AU = author names, SO = publication source, DE = keywords is represented in fig 4. These elements are connected by grey lines representing the relationship among them. Left column shows the authors, in the middle the source that the authors have chosen for publishing their research work and on the right the keywords they have used. Size of the rectangle and thickness of the grey lines depicts the volume of work (Dores, 2021).

Researchers have preferred to publish more in Material Today Proceedings, followed by Acta Crystallographica Section E-Crystallographic Communications. Keywords such as mechanical properties and crystal structure are most commonly used.

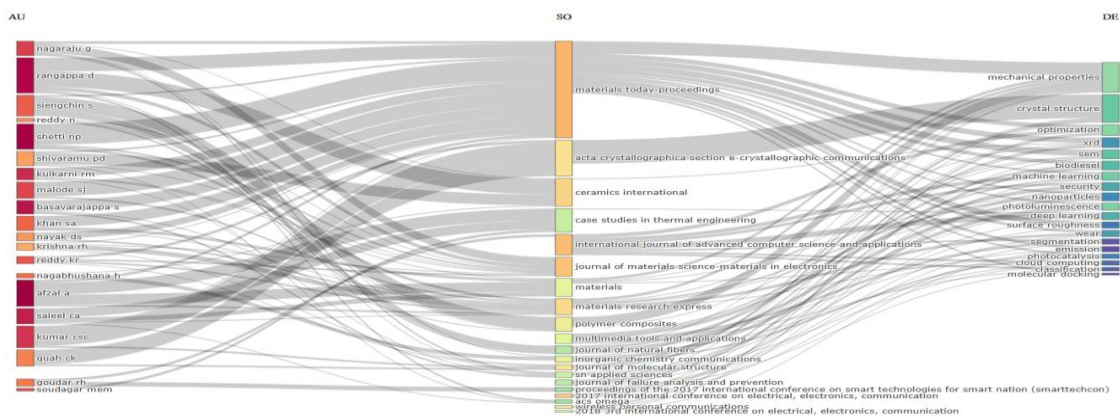


Fig. 4 Three Field Plot

The analysis shows that there were 6017 as per in fig 1. Fig 5 illustrates the top 10 prolific authors with highest publications as reflected in the web of science database. The figure illustrates Afzal, A is the prominent author with 170 publications, followed by Shetty, NP with 88, Soudagar Mem in the tenth position with 38 publications.

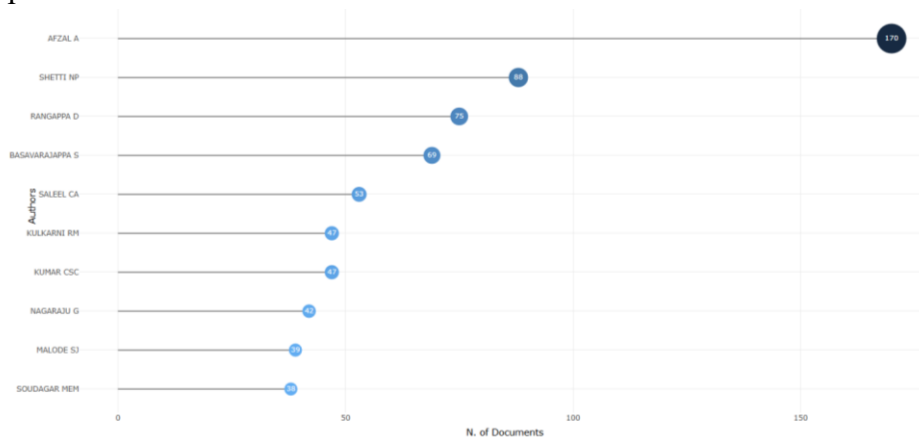


Fig. 5 Most Prolific Authors

Most trending topics were identified in the analysis with the help of keywords used by authors. Word cloud illustrates the trending topics of research in the research publications, it was extracted using the option Keywords Plus. Its thickness varies accordance to the usage. Most often used words appears in

& Nagaraja, 2020). Most of the works i.e. 2007 were published as journal articles. The result is similar to the analysis of Bhadrashetty (2021). This may be because the institutes are encouraging researchers to publish in top quartile journals which has high impact factor that are mapped in most popular scopus and web of science database. This in turn will increase the h-index of the author. Publications were at peak $n=545$ in 2021 may be because it was a covid time, faculties were handling classes in a dual mode and more time could be spent on research work. Mean citations per article was 27.01 and per year was 4.05 in the year 2019. Afzal, A was the most prolific author who published 170 documents which was almost the double the publications of second prolific author Shetty, NP who published 88 documents. Authors preferred to publish more in the Materials Today Proceedings that has 289 publications. The most trending topic of research during the study period was ‘Performance’ $f=200$ followed by ‘Behaviour’ $f=167$. R&D is improving in a faster pace. The present study focused on giving overview of research trends of VTU. This will help the policy makers in overcoming the gap in research. Research from the present study can be used to understand the growth pattern of VTU in research over 10 years. The present study provides the current status of research of VTU and enables in foreseeing the future of research.

SUGGESTIONS:

Encouraging co-authorship publication may help in widening the research outlook. Priority should be given to quality of publications. Quality can be measured by its citations. It is noted that though there were 545 publications in 2021 for which only 11.39 mean citations per article were received, it is very less when compared to 27.01 mean citations per article for only 267 publications in 2019. Incentives should be given to the authors who receives more citations in a year along with the number of publications and should be recognized by publishing it in college newsletters and websites. Evaluation metrics should be linked to citation metrics. Quality of research will improve when collaborated with international authors.

REFERENCES:

1. Aria M., & Cuccurullo C. (2017). Bibliometrix : An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, 11(4), 959–975.
2. Bachalapur M.M., & Hugar J.G. (2021). Bibliometric analysis of research publications of BLDEA’s V P Dr.P.G.Halakatti College of Engineering and Technology, Vijayapur, Karnataka. *Library Philosophy and Practice*, 4328. <https://digitalcommons.unl.edu/libphilprac/4328/>
3. Bhadrashetty A. (2021). Bibliometric analysis of research publication of Visvesvaraya Technological University, Belagavi, Karnataka. 5(2/3), 1–8.
4. Das A.K., & Karanjai A. (2002). Institutional distribution in computer science research in India: A study. *Annals of Library and Information Studies*, 49(1), 23–28.
5. D’Souza F. (2021). Research publications trend of St Joseph engineering college, Mangaluru, Karnataka: A bibliometric study. *Library Philosophy and Practice*, 49924. <https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=9136&context=libphilprac>
6. Dores J., Biju, T. & Sanu, F. (2021). Mind the gap: A bibliometric analysis on unrecognized role of women in fisheries sector. *International Journal of Mechanical Engineering*, 6, 686–705.
7. Elwardany M., Nassib A.M., & Mohamed H.A. (2024). Analyzing global research trends in combined cycle power plants: A bibliometric study. *Energy Nexus*, 13:100265

8. Fitriani A, Rosidah., & Zafrullah. (2023). Biblioshiny: Implementation of artificial intelligence in education (1976-2023). *Journal of Technology Global*, 1(1), 11–25.
9. Gangadhar K.C., & Nagaraja A. (2020). Research performance of engineering colleges in Karnataka as reflected in the scopus database. *Library Philosophy and Practice*, 4766. <https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=8918&context=libphilprac>
10. Gauthier É. (1998). *Bibliometric analysis of scientific and technological research: A user's guide to the methodology*. Science Technology Redesign Project.
11. Gaviria-Marin M., Merigo J.M., & Popa S. (2018). Twenty years of the *Journal of Knowledge Management: A bibliometric analysis*. *Journal of Knowledge Management*, 22(8),1655–1687.
12. Gomez Rosselli S., & Rosselli D. (2021). Bibliometric analysis of engineering publications in Colombia, 2010-2019: A Scopus analysis. *DYNA*, 88(216), 9–14.
13. Hou W., Li X., Wen Y., & Du X. (2024). Global research trends in skiing from 1974 to 2023: A bibliometric analysis. *Heliyon*, 10(15), 1–15.
14. Kademani B.S., Kumar V., Kumar A., Sagar A., Mohan L., Surwase G., & Gaderao, C.R.,
15. (2005). Publication productivity of the bio-organic division at Bhabha Atomic Research Centre : A scientometric study. *Annals of Library and Information Studies*, 52, 135–146.
16. Kumar H.A., Dora M. & Desai A. (2015). A bibliometrics profile of Gujarat University, Ahmedabad during 2004-2013. *DESIDOC Journal of Library and Information Technology*, 35(1), 9–16.
17. Mandhirasalam, M. (2022). Scholarly publication output in engineering colleges in Coimbatore: An analysis. *Transformation of Learning Resource Centers in the Digital Era*. K.S.Rangasamy College of Technology, 391-397.
18. Martínez-López F.J., Merigó J.M., Valenzuela-Fernández L., & Nicolás C. (2018). Fifty years of the *European Journal of Marketing: A bibliometric analysis*. *European Journal of Marketing*, 52(1/2), 439–468.
19. Mohamed B., & Marzouk M. (2023). Bibliometric analysis and visualisation of heritage buildings preservation. *Heritage Science*, 11(101), 1-20.
20. Mokhtari H., Barkhan S., Haseli D., & Saberi M.K. (2020). A bibliometric analysis and visualization of the journal of documentation: 1945–2018. *Journal of Documentation*. 77(1), 69–92.
21. Mokhtari H., Mirezati S.Z., Saberi M.K., Fazli F., & Kharabati-Neshin M. (2019). A bibliometric analysis and visualization of the scientific publications of universities: A study of Hamadan University of Medical Sciences during 1992-2018. *Webology*. 16(2),187–211.
22. Nagaraja A., Gangadhar K.C., & Kumar M.V. (2017). Quantitative measuring of research output of engineering colleges in Karnataka based on web of science database. *Journal of Scientometric Research*, 6(1), 36–46.
23. Odoi-Yorke F., Opoku R., Davis F., & Obeng G.Y. (2024). Employing bibliometric analysis to identify the trends, evolution, and future research directions of sand-based thermal energy storage systems. *Journal of Energy Storage*, 94, 1–17.
24. Radha L, & Arumugam J. (2021). The research output of bibliometrics using bibliometrix R package and VOS viewer. *Shanlax Interational Journal of Arts, Science and Humanities*, 9(2), 44–49.
25. Su M., Peng H., & Li S. (2021). A visualized bibliometric analysis of mapping research trends of machine learning in engineering (MLE). *Expert Systems with Applications*, 186:115728.
26. Tran C., & Aytac S. (2016). Measuring scholarly productivity of Long Island Educational Institutions: Using web of science and scopus as a tool. *Evidence Based Library and Information Practice*, 11(3),

16–33.

27. Zhu J., Hassan S.U., Mirza H.T., & Xie Q. (2014). Measuring recent research performance for Chinese universities using bibliometric methods. *Scientometrics*, 101, 429–443.