

Scientific Productivity of Central University of Himachal Pradesh: A Bibliometric Analysis

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Abstract

This study examines the pattern of the Central University of Himachal Pradesh research publications between 2011 and 2020. The study used bibliometric methods to analyse data retrieved from the Scopus database. Google Spreadsheet and VOSviewer software were used for the analysis and visualisation. The research covers mainly the year-wise publication, the most productive authors, the subject areas, the types of documents, preferred publications, research collaboration, and highly cited articles. This study showed that the Central University of Himachal Pradesh (CUHP) published 442 publications and received 5,531 citations during 2011-2020. Akhter, Y. from the School of Life Sciences had published the highest number (60) and received 746 citations, with an ACPP of 12.43 and h-index of 16. It was also found that most of the publications of CUHP have collaborated with Babasaheb Bhimrao Ambedkar University at the national level and Universidade Estadual de Campinas, Brazil, at the international level.

Keywords: Bibliometric Analysis, Research Output, Scopus, CUHP, Citations, VOSviewer, Scientometric, University Research

Introduction

The quantitative analysis of research publications is one of the essential criteria for analysing or ranking different universities. This analysis is based on the publication data from various bibliographic indexing databases, like Scopus, Web of Science, and so on, or higher education regulatory body lists like UGC CARE list. The analysis is based on multiple parameters, like number of publications, number of citations, collaboration at different levels, and so on. These parameters are also known by an umbrella term 'bibliometric'. Allan Pritchard coined the

term bibliometric in 1969. Bibliographic analysis of the research output of an university is meant to explore the impact of the published research output of that university on the academic community of the university, as well as on the immediate society (Panda, 2021).

About Central University of Himachal Pradesh (CUHP)

The Fifteenth Parliament of the Republic of India passed the Central University Act 2009, and the Hon'ble President of India gave its assent on March 20, 2009. The act aims "to establish and incorporate universities for teaching and research in the various States and to provide for matters connected therewith or incidental thereto". Under this act, 13 central universities were established in the 12 states of India, and the status of three universities was changed from state to central university.

The Central University of Himachal Pradesh (hereafter CUHP) is one such university, out of the 12 newly established universities under the Central Universities Act 2009 (No. 25 of 2009) enacted by the Parliament. The territorial jurisdiction of CUHP is the whole of the state of Himachal Pradesh. Himachal Pradesh is a state of hilly terrain, also known as "God's Place" (Dev Bhoomi). CUHP is funded and regulated by the University Grants Commission (UGC). The university runs from three campuses, i.e., Dhauladhar Parisar Dharamshala, Shahpur Campus, and Sapt Sindhu Parisar Dehra. The headquarters of the campus is at Dharamshala. Presently, there are 15 schools of studies, 65 departments, and 81 centres of studies approved. The university offers many courses, ranging from certificate, diploma, undergraduate to postgraduate, and Ph.D.

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Literature Review

Researchers predominantly use bibliometric methods to analyse the research output of institutions. In this review, some of the studies mainly related to Indian universities were highlighted.

Sevukan and Sharma (2008) analyzed the research output of biotechnology faculties in some Indian central universities of India from 1997-2006. The data were retrieved from two databases, namely PubMed and the Web of Science database. Bibliometric techniques were used to analyse the data. This study found the yearly distribution publications of central universities in India in biotechnology from 1997-2006. The highest number of publications 140 (42.55%) was in 2006 followed by JNU 84 (25.53%) and AMU 51 (15.50%). In the study, single-authored papers were 5 (1.52%), followed by two-authored papers, which was the highest in number, 111 (33.74%), and three-authored papers 82 (24.92%).

In one study, Kumar and Dora (2012) analyzed the research performance of Indian Institute of Management Ahmedabad during 1999-2010. The data were retrieved from the SCOPUS and Web of Science databases, and the results were tabulated in MS Excel. In the study, the growth in papers was steadily increasing. The Indian Journal of Agricultural Economics was the most preferred journal, followed by the European Journal of Operational Research and the Indian Journal of Labour Economics.

The study by Siwach and Kumar (2015) examined the research output of Maharshi Dayanand University (Rohtak) during 2000-2013. Around 1,247 papers published during 2000-2013 were analysed through the SCOPUS database and received 6,959 citations. This study found the highest number of articles published in 2013 (219 papers) and the lowest in 2001 (30 papers). The most elevated national collaboration was with Guru Jambheshwar University of Science and Technology and at the international level, the highest number of collaborative papers was with South Korea (56 documents) and the United States (26 articles).

Nagarkar et al. (2015) conducted a Bibliometric analysis of Savitribai Phule Pune University faculty of life science during 1999-2013. In this study, Web of Science (WoS) database was used. This study found that a total of 690

research papers were published in 15 years of study (1999-2013) in 362 journals, and received 6,210 citations. In this study, HistCite, Intcoll, Pajek, and VOSviewer software tools were used.

A study by Dwivedi (2017) found the research productivity of Banaras Hindu University during 1989-2016. Sixteen thousand five hundred 56 records were retrieved from Web of Science and Science Citation Index databases. This study received the maximum number of publications in 2013, whereas the minimum was observed in 1995. The highest international collaboration was with the USA (607 publications), followed by Germany with 471 publications. CSIR had the maximum collaborations, with 443 publications, which DRDO follows with 280 publications. O. N. Shrivastava, Department of Physics, had the maximum number of publications (346), whereas C. P. Singh of the same department received maximum citations (18,528).

Another study conducted by Siwach and Parmar (2018) analyzed the research contributions of CCS Haryana Agricultural University, Hisar during 2001-2015. Two thousand six hundred forty-nine papers published during 2001-2015 were analyzed through SCOPUS. For bibliometric analysis of data, MS Excel tools were used, and Tagxedo20 (www.tagxedo.com) was used for creating a cloud cluster of the author keywords. This study shows the year-wise distribution of the publication, collaborations at the national and international level, most preferred sources of publications, and most productive authors.

Doulani (2020) was conducted a bibliometric analysis of scientific publications of Alzahra University during 1986-2019. A total of 3,726 articles were published by Alzahra University in the Scopus database in the period 1986-2019, and received 41,464 citations. For the analysis of data, MS Excel, VOSviewer, and CRExplorer software were used. In this study, they found that the highest number of publications was in 2018. The highest citations, 3,532, were received in 2016. The highest h-index with self-citations (31) was received in 2015 and 2014. The University of Tehran has the most increased collaborations with the Alzahra University, which is followed by Shahid Beheshti University and Islamic Azad University, Mashhad Branch. Mohammad Heravi is the most productive author having 731 papers, 66 h-index, and 15,788 citations received.

In one study, Jalal and Koner analyzed the research collaboration of University of Calcutta by faculty members in physics during 2001-2019. A total number of 775 papers were published in the SCOPUS database in 2001-2019, receiving 9,090 citations. The Bibliometrix R Package software was used for the analysis of data. This study found that the highest number of publications (64) was in 2015. Debnarayan Jana is the most productive author, with 92 publications, 19 h-index, and 1,572 citations received. In the study, single authorship was 43 (5.5%) and three-authored articles were 173 (22.32%), followed by two-authored articles, which was 146 (18.84%), in the period 2001-2019.

The study by Vyas and Trivedi (2021) examined the research trends of state universities of Gujarat during 2015-2019. The SCOPUS database extracted 3,825 publications from 2015-2019 of Gujarat's six-state government universities. MS Excel was used to analyse the data. The highest number of publications, 1,597 (41.75%), was published by MSU – The Maharaja Sayajirao University of Baroda, followed by 1,057 (27.63%), the number of publications issued by GU – Gujarat University.

In one study, Parabhoi et al. (2021) conducted a bibliometric analysis of 14 private universities of Himachal Pradesh between 2004 and 2019. Around 3,923 publications of 14 Universities of Himachal Pradesh were extracted from the Scopus database, exported in CSV file and BibTex file format, and then used for further analysis. This study found that 2019 was the most productive year. The highest citations (18,246) were received by Jaypee University, followed by Shoolini University, with 17,182 citations.

Objectives

- To know the year-wise publications of CUHP during 2011-2020.
- To know the preferred sources of publications.
- To know the most productive authors of CUHP during 2011-2020.
- To know the highly cited articles.
- To know the national and international collaborations of CUHP for research publications.
- To know the co-occurrence of keywords.

Methodology

The Scopus database was used to retrieve the publication data of CUHP. The Scopus was searched with the name of the affiliation, i.e., Central University of Himachal Pradesh. It was found that Scopus retrieved 543 results from 2011 to 2022. The objective of the present study is to examine the research productivity from 2011 to 2020, so we excluded 101 publications of 2021 and 2022. The citations, bibliographic fields, and keywords of 442 publications were exported in the CSV file format. Google Spreadsheet was used for the analysis, and VOSviewer was used to visualise the network of author collaboration and co-occurrence of keywords.

The following search query was used to retrieve data from the Scopus.

AF-ID (“Central University of Himachal Pradesh” 60107368) AND (EXCLUDE (PUBYEAR, 2022) OR EXCLUDE (PUBYEAR, 2021))

Result and Discussions

Year-Wise Growth

Table 1: Year-Wise Publication of CUHP during 2011-2020

Year	Publications	Percentage	Total Citations	ACPP
2020	107	24.21	507	4.73
2019	63	14.25	809	12.84
2018	84	19.00	1105	13.15
2017	59	13.35	1314	22.27
2016	49	11.09	905	18.47
2015	31	7.01	266	8.58
2014	14	3.17	237	16.93
2013	22	4.98	289	13.14
2012	7	1.58	21	3.00
2011	6	1.36	78	13.00
Total	442	100	5531	126.11

The year-wise publication of the Central University of Himachal Pradesh (CUHP) from 2011 to 2020 is shown in Table 1. In this period, 442 publications were published by

the scholars of the university. These publications received total citations of 5,531, with an average citation per paper (ACPP) of 12.61. The highest number of articles (107) were published in 2020 (24.21%, ACPP: 4.73). The least number of articles (six) were published in 2011 (1.36%, ACPP: 13). Interestingly, the 59 publications in 2017 have received the highest number of citations (1,314, ACPP: 22.27).

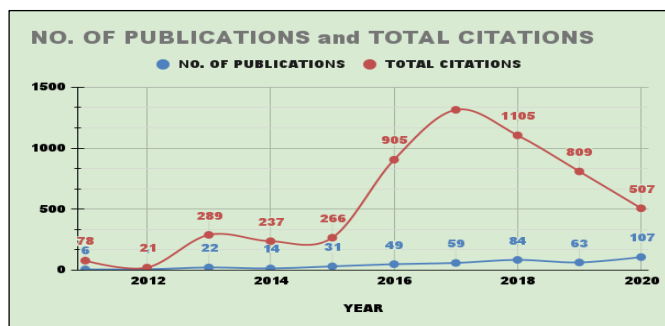


Fig. 1: Year-Wise Distribution of Publications and Citations of CUHP, from 2011 to 2020

Published Document Types

Table 2: Types of Documents

Document Type	Publications	Percentage
Article	350	79.18
Review	36	8.14
Book Chapter	26	5.88
Conference Paper	18	4.07
Erratum	4	0.90
Note	3	0.67
Short Survey	2	0.45
Book	1	0.22
Editorial	1	0.22
Letter	1	0.22
Total	442	100

Table 2 shows the most preferred document types published by the authors. Out of 442 documents, 350 (79.18%) were published as articles, followed by 36 (8.14%) as reviews, 26 (5.88%) as book chapters, and 18 (4.07%) as conference papers; a minimal number of publications were published as errata 4 (0.90%), notes

3 (0.67%), short surveys 2 (0.45%), books (0.22%), editorials 1 (0.22%), and letters 1 (0.22%).

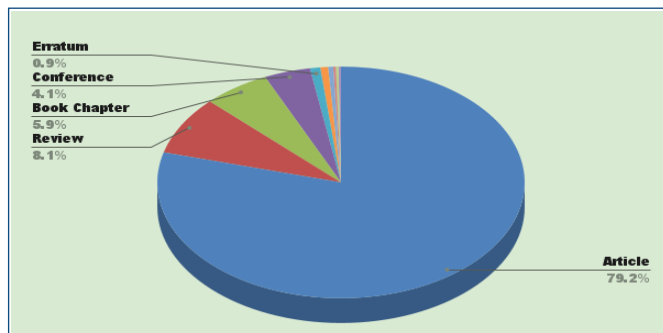


Fig. 2: Document Type of Publications of CUHP

Subject Area of Published Research

Table 3: Subject Area of Research

Subject Area	Publication	Percentage
Physics and Astronomy	104	13.13
Biochemistry, Genetics and Molecular Biology	79	9.97
Engineering	73	9.21
Environmental Science	69	8.71
Materials Science	62	7.82
Chemical Engineering	46	5.80
Chemistry	38	4.79
Social Sciences	38	4.79
Earth and Planetary Sciences	34	4.29
Mathematics	30	3.78
Agricultural and Biological Sciences	29	3.66
Energy	29	3.66
Immunology and Microbiology	26	3.28
Computer Science	24	3.03
Multidisciplinary	24	3.03
Business, Management and Accounting	23	2.90
Medicine	21	2.65
Economics, Econometrics and Finance	19	2.39
Pharmacology, Toxicology and Pharmaceutics	8	1.01

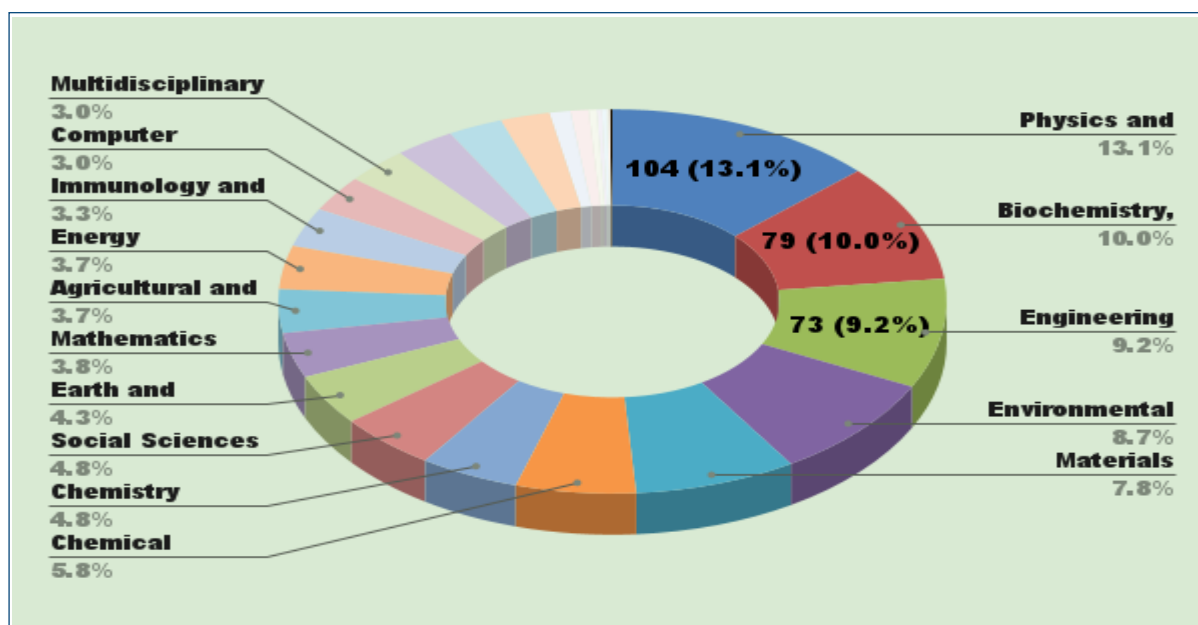


Fig. 3: Subject-Wise Distribution of CUHP Publications

Table 3 shows the subject-wise research output of CUHP as per the SCOPUS database subject area of research. The largest number of publications, 104 (13.1%), were classified under physics and astronomy, followed by 79 (10.0%) in biochemistry, 73 (9.2%) in engineering, 69 (8.7%) in environmental science, and 62 (7.8%) in materials science. The analysis shows that science subjects are dominating in the publications of CUHP.

Source of Research Publications

Table 4: Preferred Sources of Publications

Source Title	Publication	Cite Score	SJR	SNIP
Environmental Science and Pollution Research	10	5.5	0.845	1.114
AIP Conference Proceedings	9	0.7	0.177	0.314
International Journal of Biological Macromolecules	8	8.5	1.140	1.579
Scientific Reports	7	7.1	1.240	1.377
Current Science	5	1.5	0.281	0.675
Journal of Electronic Materials	5	3.3	0.422	0.646
Advances in High Energy Physics	4	3.0	0.590	0.542

Source Title	Publication	Cite Score	SJR	SNIP
Biochimie	4	6.1	1.254	1.014
Bioresource Technology	4	14.8	2.489	2.073
Environmental Monitoring and Assessment	4	3.6	0.590	963
Journal of Molecular Liquids	4	8.4	0.929	1.42
Journal of Porous Media	4	2.4	0.386	0.654
Nuclear Physics A	4	3.6	0.782	0.696
Plos One	4	5.3	0.990	1.349

The analysis found that authors from science departments have published in both high cite and SJR score journals. The top 14 journals are listed in Table 4, along with the number of publications, their cite score, SJR, and SNIP. The highest number of publications (ten) are published in Environmental Science and Pollution Research (Cite Scores: 5.5, SJR: 0.845, SNIP: 1.114), followed by nine publications in AIP Conference Proceedings (Cite Scores: 0.7, SJR: 0.177, SNIP: 0.314), eight publications in International Journal of Biological Macromolecules (Cite Scores: 8.5, SJR: 1.14, SNIP: 1.579), and seven publications in Scientific Reports (Cite Scores: 7.1, SJR: 1.24, SNIP: 1.377). The analysis found that four publications are published in each high-ranked sources,

like Bioresource Technology (Cite Scores: 14.8, SJR: 2.489, SNIP: 2.073), Journal of Molecular Liquids (Cite

Scores: 8.4, SJR: 0.929, SNIP: 1.42), and Biochimie (Cite Scores: 6.1, SJR: 1.254, SNIP: 1.014).

Most Productive Authors

Table 5: Most Productive Authors of CUHP during 2011-2020

Author Name	CUHP School	Publication	Citation	ACCP	H-Index
Akhter, Y.	School of Life Sciences	60	746	12.43	16
Pant, D.	School of Earth & Environmental Science	31	321	10.35	10
Singh, R. K.	School of Physical & Material Sciences	31	1865	60.16	19
Kumar, R.	School of Mathematics, Computer & Information Sciences	27	384	14.22	11
Sandhu, P.	School of Life Sciences	21	371	17.66	12
Mahajan, A. K.	School of Earth & Environmental Sciences	18	133	7.38	7
Verma, S. K.	School of Life Sciences	16	101	6.31	6
Ahmed, M.	School of Earth & Environmental Sciences	15	104	6.93	7
Kumar, J.	School of Physical & Material Sciences	14	30	2.14	3
Verma, S.	School of Physical & Material Sciences	14	23	1.64	3

Table 5 shows the most prolific authors, who have been published 14 or more times from 2011 to 2020. The two authors, Kumar, R. (27 publications, 1,846 citations) and Moshkalev, S. A. (21 publications, 1,176 citations), were not included in the list, as they were not affiliated with CUHP. Again, Table 5 shows that author Akhter, Y. from the School of Life Sciences had published the highest number (60) and received 746 citations, with an ACCP of 12.43 and h-index of 16. Singh, R. K. from the School of Physical & Material Sciences received the highest number of citations (1,865) from 31 publications.

National Level Collaboration

Table 6: National Level Collaboration of CUHP from 2011 to 2020

Affiliation	Publication	Country
Babasaheb Bhimrao Ambedkar University	22	India
Shoolini University	15	India
Himachal Pradesh University	14	India
Jamia Millia Islamia	14	India
Jawaharlal Nehru University	14	India
Wadia Institute of Himalayan Geology	12	India
University of Hyderabad	10	India
Guru Nanak Dev University	8	India
Tripura University	8	India
Indian Institute of Technology Roorkee	8	India
Central University of Haryana	8	India

The Central University of Himachal Pradesh had collaborated with reputed national institutions in India. The top ten institutions with which the university has collaborated are shown in Table 6. During 2009-2020, the highest of collaborations (22) were with Babasaheb Bhimrao Ambedkar University, followed by Shoolini University (15). Other collaborations include Himachal Pradesh University (14), followed by Jamia Millia Islamia (14), Jawaharlal Nehru University (14), Wadia Institute of Himalayan Geology (12), University of Hyderabad (10), Guru Nanak Dev University (eight), Tripura University (eight), Indian Institute of Technology Roorkee (eight), and Central University of Haryana (eight). It was found that two of the universities from the top three most collaborative institutions were from Himachal Pradesh.

International Collaboration

Table 7: International Collaboration of CUHP from 2011 to 2020

Affiliation	Publication	Country
Universidade Estadual de Campinas	23	Brazil
COMSATS University Islamabad, Sahiwal Campus	13	Pakistan
Centre for Information Technology Renato Archer CTI	9	Brazil
Toyohashi University of Technology	9	Japan
Universidad de Santiago de Chile	9	Chile
Babol Noshirvani University of Technology	8	Iran

Affiliation	Publication	Country
Chonnam National University	4	South Korea
Duy Tan University	4	Vietnam
Universidade Estadual Paulista Júlio de Mesquita Filho	3	Brazil
John Innes Centre	3	United Kingdom
Università degli Studi di Milano	3	Italy
Ton-Duc-Thang University	3	Vietnam

International collaborations of CUHP are presented in Table 7. The Central University of Himachal Pradesh has the highest collaborative publications with Universidade Estadual de Campinas, Brazil (23), followed by COMSATS University Islamabad, Sahiwal Campus, Pakistan (13), Toyohashi University of Technology, Japan (nine), Universidad de Santiago de Chile, Chile (nine), and Babol Noshirvani University of Technology, Iran (eight).

Highly Cited Research Publications

Table 8: Highly Cited Articles

Author	Title	Citations
Singh R. K., Kumar R., Singh D. P.	Graphene oxide: Strategies for synthesis, reduction and frontier applications	246
Sharma S., Chatterjee S.	Microplastic pollution, a threat to marine ecosystem and human health: A short review	212
Kumar R., Singh R. K., Vaz A. R., Savu R., Moshkalev S. A.	Self-assembled and one-step synthesis of interconnected 3D network of Fe ₃ O ₄ /Reduced graphene oxide nanosheets hybrid for high-performance supercapacitor electrode	198
Kumar R., Sahoo S., Joanni E., Singh R. K., Tan W. K., Kar K. K., Matsuda A.	Recent progress in the synthesis of graphene and derived materials for next generation electrodes of high performance lithium ion batteries	178
Jaiswal D., Kant R.	Green purchasing behaviour: A conceptual framework and empirical investigation of Indian consumers	167
Kumar R., Joanni E., Singh R. K., Singh D. P., Moshkalev S. A.	Recent advances in the synthesis and modification of carbon-based 2D materials for application in energy conversion and storage	145
Kumar R., Singh R. K., Singh D. P., Joanni E., Yadav R. M., Moshkalev S. A.	Laser-assisted synthesis, reduction and micro-patterning of graphene: Recent progress and applications	140
Singh D. P., Herrera C. E., Singh B., Singh S., Singh R. K., Kumar R.	Graphene oxide: An efficient material and recent approach for biotechnological and biomedical applications	126
Kumar R., Sahoo S., Joanni E., Singh R. K., Yadav R. M., Verma R. K., Singh D. P., Tan W. K., Pérez del Pino A., Moshkalev S. A., Matsuda A.	A review on synthesis of graphene, h-BN and MoS ₂ for energy storage applications: Recent progress and perspectives	117
Kumar R., Sahoo S., Joanni E., Singh R. K., Maegawa K., Tan W. K., Kawamura G., Kar K. K., Matsuda A.	Heteroatom doped graphene engineering for energy storage and conversion	114

Table 8 shows that the paper entitled ‘Graphene oxide: Strategies for synthesis, reduction and frontier applications’ by Singh R. K., Kumar R., Singh D. P., published in Royal Society of Chemistry, 2016, received the highest number

of citations (246), followed by the article ‘Microplastic pollution, a threat to marine ecosystem and human health: A short review’ by Sharma S., Chatterjee S., published in Springer Verlag, 2017, which received 212 citations.

Co-occurrence of all Keywords

Table 9: Most Popular Keywords

Keyword	Occurrences	Total Link Strength
India	8	6
Microwave	7	4
Density Functional Theory	5	6
Internet of Things (IoT)	5	9
Molecular Docking	5	10
Mycobacterium Tuberculosis	5	13
Reduced Graphene Oxide	5	7
Aegilops	4	7
Efflux Pumps	4	12
Fog Computing	4	9

Keywords are an essential component of scholarly communications. Every publishing source of scientific

communication asks for keywords which describe the theme of the studies. In general, there are two types of keywords, i.e., author keywords and index keywords. The authors provide author keywords at the time of submission. Indexing databases like Scopus, Web of Science, and so on computationally extract some keywords from the articles. These keywords are known as index keywords. In this analysis, we have considered only author keywords. The minimum occurrence of keywords was set to two. The 198 keywords out of 1,526 keywords met the threshold. Further, the largest set of connected keywords consists of 55 keywords only. The resulting network visualisation of keyword co-occurrence is shown in Fig. 4. The keywords India (total link strength 6), microwave (total link strength 7), molecular docking (total link strength 10), and mycobacterium tuberculosis (total link strength 13) were the most common. The top ten keywords, in terms of high number of occurrences, with their respective total link strength are listed in Table 9. The result shows that most of the keywords are from studies on the subject of natural sciences.

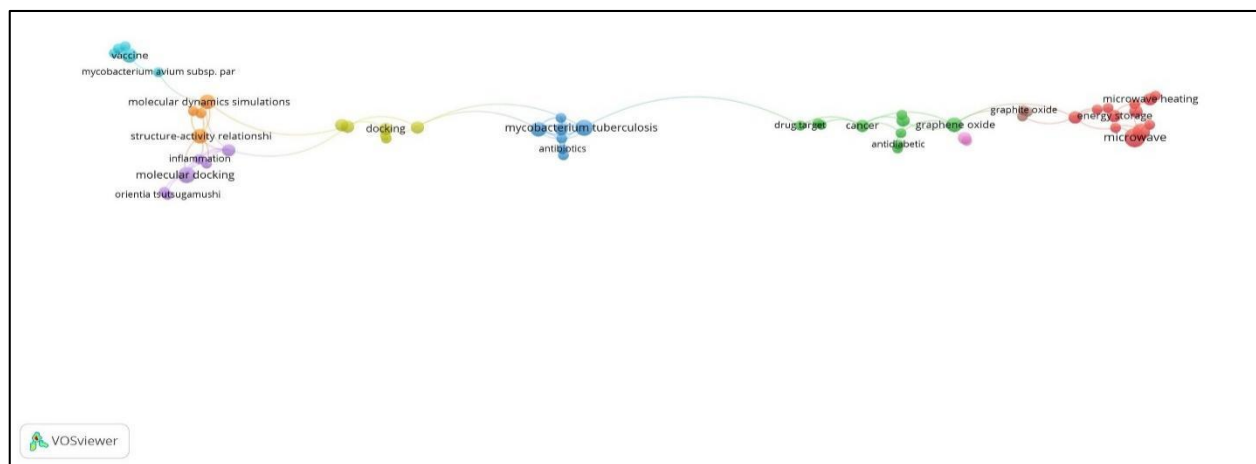


Fig. 4: Co-Occurrence of Author Keywords in the Publications of CUHP

Limitations

In the present study, the analysis was limited to the Scopus database only. The results of the study may deviate with the analysis of other databases like Web of Science, and so on.

Conclusion

The present study has explored the scientific productivity of the Central University of Himachal Pradesh during the

period 2011-2020. This study examined 442 publications in the SCOPUS database. It was seen from the results that there is an upward trend in the number of publications and citations. A major chunk of research papers was published in 2020 (122, 23%). However, the most citations were received in 2017 (1250, 22.37%). A majority of the documents were published on the science subjects, with a very few on social sciences, arts, and humanities. This was also seen from the results of keyword co-occurrence analysis, as most of the keywords were related to the sciences. The authors from the science departments have

published in both high cite score and SJR score journals. At the national level, CUHP had the maximum collaboration with Babasaheb Bhimrao Ambedkar University (22), and at the international level, CUHP had the maximum collaboration with Universidade Estadual de Campinas, Brazil (23). The present study shows that a majority of the Scopus-indexed publications of CUHP were from the sciences, and a few from the social sciences and humanities departments. However, it is also true that very few journals from the domain other than natural sciences are Scopus indexed. The results will be clearer if Scopus has more coverage of journals from social sciences and humanities. The analysis of other publications of CUHP, which are not indexed in Scopus, will be explored in the future.

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