Research Article

Measuring the Research Productivity of Deenbandhu Chhotu Ram University of Science and Technology during 2011-2021: A Scientometric Analysis

Rohit

School of Library and Information Science, Central University of Gujarat, Gandhinagar, Gujarat, INDIA.

ABSTRACT:
This paper presents a scientometric analysis of Deenbandhu Chhotu Ram University of Science and Technology research performance as seen through the Scopus database from 2011 to 2021. The study intended to investigate the annual growth of research and citation impact, top-productive authors, authorship pattern, core sources and level of collaborations, etc. Bibliometrix R-Package, MS-Excel, and VOSviewer software are used for data analysis and visualisation. The results show that out of 1502 papers, the maximum publications 256 published in 2021 and a minimum of 34 in 2011 (2%), *"AIP Conference Proceedings"* was the most preferred source for research communication (72 papers), Sanjeev Maken ranked first among all authors with 74 articles, and the 3-authored (451 articles) was the favoured authorship pattern. Furthermore, the authors published the maximum number of papers in the Engineering discipline. This study shows the trends of scholarly contributions at DCRUST. These study findings can help to understand the publication trends, research's uniqueness and impact.

Keywords: Scientometric, DCRUST, Scopus, Haryana, Research Productivity.

Correspondence
Rohit
PhD Student, School of Library and Information Science, Central University of Gujarat, Gandhinagar-382030, Gujarat, INDIA.
Email id: roheetjangra@gmail.com
ORCID: https://orcid.org/0000-0001-7415-2697

INTRODUCTION

The scientometric method is used to assess research performance and impact. These are the essential tools to measure research and development in a quantitative and qualitative manner. Using various scientometric indicators, one can easily quantify an institution's research growth and performance and easily understand growth trends in many fields.[1] Deenbandhu Chhotu Ram University of Science and Technology (DCRUST) is one of the premiers among all universities in Haryana state. The Haryana Government founded it in 1986 as an Engineering College in Sir Chhotu Ram's memory. Later in 2006, this college was upgraded into a university through the state government Act 29 (2006).[2] This university accreted with grade 'A' by NAAC in 2017. So far, no assessment study has applied to this university.

To display a more precise picture of the university's contribution and understand how it changed over time, the present study attempts to analyse the growth and development of the university's research productivity indexed in the Scopus.

LITERATURE REVIEW

The literature review is essential to find a new research topic and research gap. Over time, many researchers have conducted assessment studies to map the research outcomes of an institute, particularly in the HEI sector in India.

Siwach and Parmar,[3] studied the research trends at Haryana Agricultural University. They collected citation data from Scopus database from 2001 to 2015 and observed that nearly half of the articles were published in ten sources, and *Annals of Biology* was the most preferred journal. Lakshman and Devi,[4] analysed the research output of Kerala University from 2001 to 2018. They collected 1972 documents through the Web of Science database, including 166 Government funding agencies. The study results show that Chemistry has the highest funded publications, while 25 agencies

fund geology subject. University Grants Commission leads at the domestic level, and the USA was the leading funder globally. Keshava et al.[5] performed a scientometric analysis of Tumkur University's publication output. They extracted 646 documents from Scopus Database for fifteen years. This study analyses the research growth rate, citation impact and authorship pattern. The study results in 2015, the maximum number of publications was published, and the university authors contributed more collaborative papers than single-authored. Santhakumar et al.[6] studied the research productivity of Madras University for ten years. They retrieved 3283 records from the Web of Science database and found that productivity has a diverging trend in the publication pattern. The study findings conclude that the university produces the largest share of papers in chemistry, and authors prefer UK-based journals to publish their research. Singh et al.[7] examined the Forest Research Institute's research productivity from 1990 to 2019 by collecting data from the Scopus database. The study findings reveal the maximum publications and citations recorded in 2008 and 2007, respectively. Agri and Biological Sciences, Environmental Studies and Biochemistry are the key research areas at Forest Research Institute. Chaturbhuj and Motewar,[1] conducted a scientometric study of the research output of Savitribai Phule Pune University from 2001 to 2019. A total of 6449 documents were retrieved from the Web of Science database to analyse the specialisation index and research priority index. The study also measures various rankings such as author's production, top-cited authors, most-cited sources and most preferred journals. Kappi et al.[8] analysed the research output of universities in Karnataka state from 2010 to 2019 by collecting bibliographic data from the Web of Science database. They selected Karnataka University, Bangalore University and Mysore University. This study observed a continuous increase in research output, and Mysore University produced a larger share of total research output. Mondal and Chakrabarti,[9] assessed the research growth of IISERs as seen through the Web of Science. They explained that IISER Pune had contributed the maximum number of papers. Chemistry and Physics were the key research areas. These IISERs collaborate with the Tata Institute of Fundamental Research at the domestic level and globally with Germany, USA and UK. Pandya et al.[10] mapped the research output of newly established twelve central universities in various states. They collected 3927 records using Scopus from 2010 to 2019, and research publications revealed significant growth. The highest number of 765 publications contributed by Central University of Rajasthan amid the selected universities, and chemistry was the top contributed subject area. Shettar and Hadagali,[11] analysed the research collaboration pattern of NITs for 20 years from 1999 to 2018, using the clarivate's citation database. They applied several parameters: collaboration degree, collaboration index, and modified collaborative coefficient. The study results reveal that the collaboration degree lies between 0.88 to 0.98 during the period. Mukherjee and Sing,[12] examined the collaboration pattern of 3 top-ranked universities based on NIRF ranking using the Web of Science from 2000 to 2020. They observed that Jawahar Nehru University has the most significant collaboration with the University of Delhi, and physics has more collaborative documents.

OBJECTIVES

The primary study objectives are the following:

- To study the publication growth and impact of DCRUST.
- To estimate the growth rate.
- To examine the pattern of authorship and collaborative measures.
- To know the core sources preferred by researchers.
- To know the most occurred author's keywords.
- To know the top research collaborators domestic and globally.
- To know the major research themes.

MATERIALS AND METHODS

The current study intends to measure the research output of Deenbandhu Chhotu Ram University of Science and Technology. The scientometric analysis method has been employed to evaluate the research productivity from 2011 to 2021. This method includes quantitative measurement of scholarly research, publishing trends, prolific authors, country, organisation, etc. Scopus,[13] database was chosen for its broad coverage, and the data was retrieved using the affiliation search tag. The string used to extract data is given as follows:

AF-ID ("Deenbandhu Chhotu Ram University of Science and Technology" 60076923) AND (LIMIT-TO (PUBYEAR, 2011-2021)).

A total of 1502 articles were fetched and downloaded in the csv format. Various bibliometric indicators were used to analyse the data to fulfil the research objectives; data was processed using the Biblioshiny from the R-Bibliometrix,[14] package, and VOSviewer software was used to visualise the citation graph.

DATA ANALYSIS AND DISCUSSION

Annual Publication Growth

Table 1 shows the annual growth of DCRUST publications from 2011 to 2021. The authors published 1502 publications with 12377 citations received during this period. The university has an h-index of 47 and an ACPP of 8.82. The maximum number of 256 publications were published in 2021, followed

Table 1: Annual publication growth and Citation received.

Year	TP	TP (%)	TC	WSC	AC$_{100}$	ACPP	h-index
2011	34	2.26	428	365	0	12.59	10
2012	86	5.73	1062	890	2	12.35	17
2013	75	4.99	999	776	1	13.32	16
2014	101	6.72	894	633	0	8.85	18
2015	130	8.66	2080	1567	3	16.00	29
2016	120	7.99	1265	912	2	10.54	19
2017	106	7.06	1738	1353	2	16.40	23
2018	153	10.19	1553	1178	1	10.15	20
2019	193	12.85	1157	886	0	5.99	17
2020	248	16.51	965	730	0	3.89	18
2021	256	17.04	236	175	0	0.92	11
Total	**1502**	**100**	**12377**	**9465**		8.24	47

TP = Publication Count, TC = Citation Count, WSC = Without Self-Citation, ACPP = Average Cites Per Paper, AC100 = Papers having at least 100 or more citations
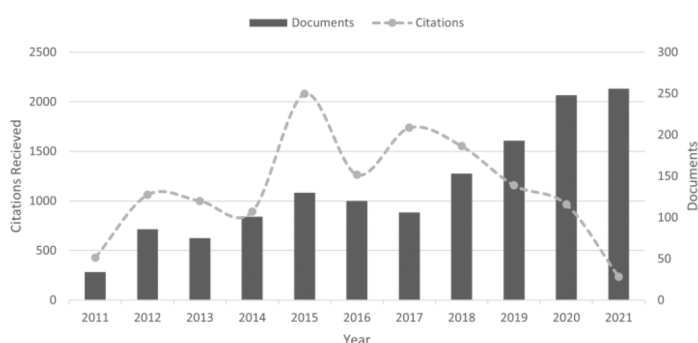

Figure 1: Annual growth vs Citation received.

Table 2: Form-wise distribution.

Publication Type	TP	TC	ACPP	h-index
Article	1,003	9819	9.79	45
Conference Paper	361	934	2.59	15
Review	73	1491	20.42	19
Book Chapter	42	102	2.43	6
Erratum	15	7	0.47	1
Editorial	3	-	-	0
Data Paper	2	-	-	0
Book	1	4	4	1
Letter	1	-	-	0
Retracted	1	32	32	1
Total	1502			

Table 3: Discipline-wise Contribution.

Subject	TP	TC	ACPP	h-index
Engineering	585	4154	7.10	32
Materials Science	403	4884	12.12	37
Physics and Astronomy	357	3039	8.51	32
Computer Science	325	1946	5.99	24
Chemistry	222	3170	14.28	33
Mathematics	170	391	2.30	10
Chemical Engineering	150	1582	10.55	26
Energy	146	1739	11.91	21
Biochemistry, Genetics and Molecular Biology	117	1422	12.15	20
Environmental Science	76	343	4.51	13

by 2020 and 2019, 248 and 193 articles. The minimum number of papers (34) was published in 2011. The average per paper citation was highest in 2017 (16.40), followed by 2015 (16.00). Figure 1 illustrates publication and citation annual growth.

Form-wise Distribution

Research documents were published in many formats during the study time. Different types of publications analysed in the current study are given in Table 2.

Discipline-wise Contribution

Table 3 depicts the distribution of DCRUST's contributions discipline-wise. The university's main subject area for research is Engineering, with the largest share (585 articles), followed by Materials Science (403), Physics and Astronomy (357) and Computer Science (325). The actual number of articles is much more, as Table 3 depicts only the top ten subject areas. The mean citation per paper was found highest for Chemistry (14.28), followed by Biochemistry (12.15) and Materials Science (12.12). Materials Science has the highest h-index (37), followed by Physics and Engineering (32).

Growth Rate and Doubling Time

Table 4 describes the rate of relative growth with a doubling time of the DCRUST records from 2011 to 2021. RGR is calculated to evaluate the publication's growth over time. The highest growth rate (0.928) was observed in 2014, and a 21.828 doubling time value was in 2021 during the study period. The following formula is used to calculate the T$_d$ for papers;

$$T_d = \frac{0.693}{RGR}$$

Research Collaboration

DCRUST authors collaborated with many domestic and global institutions for their research. The top ten institutions which collaborated with DCRUST are shown in Table 5. The university has a leading research collaboration with Maharshi Dayanand University having 139 publications along with 763 citations and 18 h-index. Guru Jambheshwar University (GJUST) has the second-highest collaboration (83 papers; 989 citations; 19 h-index), Kurukshetra University has 67

Table 4: Growth Rate and T$_d$.

Year	Publications	log$_e$ W$_1$	log$_e$ W$_2$	RGR	x̄	T$_d$	x̄
2011	34	0	3.53	0		0	
2012	86	3.53	4.45	0.928		0.747	
2013	75	4.45	4.32	-0.137		-5.064	
2014	101	4.32	4.62	0.298		2.328	
2015	130	4.62	4.87	0.252		2.745	
2016	120	4.87	4.79	-0.080	0.184	-8.658	1.452
2017	106	4.79	4.66	-0.124		-5.586	
2018	153	4.66	5.03	0.367		1.888	
2019	193	5.03	5.26	0.232		2.984	
2020	248	5.26	5.51	0.251		2.764	
2021	256	5.51	5.55	0.032		21.828	

RGR =Relative Growth Rate; T$_d$ =Doubling time, x̄ = mean.

Table 5: Collaborative Institutions.

Name	TP	TC	ACPP	AC$_{100}$	h-index
Maharshi Dayanand University	139	763	5.49	0	18
Guru Jambheshwar University of Sci. and Tech.	83	989	11.92	0	19
Kurukshetra University	67	344	5.13	0	11
National Institute of Technology Kurukshetra	61	593	9.72	2	13
University of Delhi	50	403	8.06	0	11
Indian Institute of Technology Delhi	49	713	14.55	1	15
Delhi Technological University	45	441	9.80	1	12
Gyeongsang National University	43	69	1.60	0	4
Thapar Institute of Engineering and Technology	31	304	9.81	1	6
Hindu College, Sonepat	28	237	8.46	0	11

Table 6: Collaborative Countries.

Country	TP	TC	h-index
South Korea	84	454	12
USA	47	580	14
Germany	17	315	10
Saudi Arabia	14	74	5
UK	14	55	1
Italy	12	74	6
Spain	9	58	4
Turkey	9	55	4
Australia	8	39	5
Portugal	5	56	5

Table 7: Preferred Sources.

Source	TP	TC	ACPP	SJR (2020)	CiteScore (2020)	h-index
AIP Conference Proceedings	72	109	1.51	0.177	0.7	5
Journal of Molecular Liquids	41	493	12.02	0.929	8.4	14
Advances in Intelligent Systems and Computing	30	33	1.10	-	-	3
International Journal of Pure and Applied Mathematics	26	40	1.54	-	-	2
Ceramics International	25	357	14.28	0.936	6.9	13
Materials Today: Proceedings	21	100	4.76	0.341	1.8	5
IEEE 5th Power India Conference	18	38	2.11	-	-	3
International Journal of Mathematical Analysis	18	29	1.61	-	-	3
Journal of Materials Science	18	106	5.89	0.489	4.0	7
Asian Journal of Chemistry	16	39	2.44	0.145	0.7	4

TP = Publication Count, TC = Citation Count, ACPP= Average Cites Per Paper, SJR= SCImago Rank.

shared articles with 344 citations and 11 *h*-index. The average citation per paper (14.55) was highest with IIT Delhi.

As depicted in Table 6, DCRUST has the most worldwide collaborative papers with South Korea (84 publication), followed by the USA (47 publication) and Germany (17 publication). The university has the highest *h*-index (14) in collaboration with the United States of America.

Preferred Sources for Publication

The authors published their articles in many periodicals and conferences. In Table 7, the top ten sources preferred by researchers are listed for research communication. These sources covered 18.97% of the total articles. The most preferred channel for scholarly communication by DCRUST's authors is *"AIP Conference Proceedings",* in which 72 papers were published. The *"Journal of Molecular Liquids"* published 41 articles. The following most preferred journals

are *"Advances in Intelligent Systems and Computing"* (30 papers), *"International Journal of Pure and Applied Mathematics"* (26 papers), *"Ceramics International"* (25 papers), and *"Materials Today: Proceedings"* (21 papers). The cites per paper of these sources were also calculated. The ACPP (14.28) was seen highest for the *Ceramics International* and followed by *Journal of Molecular Liquids* (ACPP=12.02) and *Journal of Materials Science: Materials in Electronics* (ACPP=5.89). The highest *h*-index for the papers published in the *Journal of Molecular Liquids* is 14, followed by *Ceramics International* (*h*-index=13).

Most Prolific Authors

Table 8 represents the ten most productive authors of the university. Among these ten authors, three are from the Department of Materials Science and Nanotechnology,

Table 8: Prolific Authors.

Name	Department	Papers	TC	ACPP	h-index
Sanjeev K Maken	Chemistry	74	799	10.80	18
Sanjay Kumar	Mathematics	70	151	2.16	7
Satish Khasa	Physics	63	640	10.16	17
Surender Duhan	Materials Science and Nanotechnology	58	1237	21.33	22
Satyapal Nehra	Energy and Environmental Studies	55	1207	21.95	24
Manju Rani	Chemical Engineering	52	590	11.35	16
Dinesh K Jain	Electrical Engineering	46	375	8.15	9
Vijay K Tomer	Materials Science and Nanotechnology	46	1237	26.89	24
Ashish Agarwal	Physics	45	638	14.18	17
Ashok K Sharma	Materials Science and Nanotechnology	41	487	11.88	17

Table 9: Authorship Pattern and Collaborative Indicators.

Year	1	2	3	4	5	≥ 6	Total	CC	CI	DC
2011	3	7	14	4	4	2	34	0.609	3.147	0.912
2012	6	20	41	10	5	4	86	0.607	3.000	0.930
2013	6	13	29	20	2	5	75	0.621	3.187	0.920
2014	5	21	36	22	12	5	101	0.641	3.297	0.950
2015	5	10	41	33	21	20	130	0.697	3.885	0.962
2016	5	24	37	30	11	13	120	0.657	3.475	0.958
2017	4	25	27	17	14	19	106	0.663	3.651	0.962
2018	6	42	44	29	14	18	153	0.642	3.373	0.961
2019	9	53	57	32	17	25	193	0.637	3.363	0.953
2020	5	65	63	30	29	56	248	0.673	3.730	0.980
2021	3	82	62	39	30	40	256	0.660	3.512	0.988

DC=Degree of Collaboration, CI=Collaboration Index, CC=Collaborative Coefficient

In the current study, the highest value of DC observed in 2021 is 0.988, followed by 2020 (0.980), (0.962) in 2015 and 2017, respectively.

Collaboration Index (CI)

Lawani,[16] determined the Collaborative Index, an average of authors per document. The formula is as follows:

$$CI = \frac{\sum_{j=1}^{k} j(f_j)}{N}$$

Table 9 shows that the CI value was highest (3.885) in 2015 and the lowest (3.000) in 2012.

Collaborative Coefficient (CC)

Ajiferuke *et al.*[17] developed the collaborative co-efficient to eliminate the shortcomings related to CI and DC.

The formula is as below:

$$CC = 1 - \frac{\sum_{j=1}^{k} (1/j)(f_j)}{N}$$

The highest value of CC was observed for the year 2015, which was 0.697; 0.673 in 2020 and 0.663 in 2017. The lowest value was 0.607 in the year 2012.

two are from the Department of Physics, and one is from chemistry, mathematics, physics, chemical and electrical engineering. Sanjeev Maken is found the most prolific author with 74 publications, Sanjay Kumar with 70 publications and Satish Khasa with 63 publications. The *h*-index is highest for Satyapal Nehra and Vijay K Tomer (24 each), followed by Surender Duhan (22) and Sanjeev K Maken (18) during the study period.

Authorship Pattern and Collaborative Measures

The annual structure of the authorship pattern is shown in Table 9.

Degree of Collaboration (DC)

This indicator measures co-authored documents published in a particular year and the total documents published in a field. The degree devised by Subramanyam[15] calculated by the formula mentioned below:

$$C = \frac{N_m}{N_m + N_s}$$

Using data in Table 9, in the year 2021;

$$C = \frac{321}{321 + 3} = \frac{253}{256} = 0.988$$

N_m = multi-authored papers, N_s = one-author papers.

Most Cited Papers and Citation Profile

The citation profile of 1502 publications is displayed in Table 10. It was found that others cited 73.57% of the total publications. Furthermore, ten papers (0.67%) received more than one hundred citations, 29 (1.93%) received between 51 to 100, 24 (1.60%) received between 41 to 50, and 566 documents (37.68%) received citations between 1 to 5.

A list of the top ten most cited documents is created in Table 11. It was observed that all of these papers were published in

Table 10: Citation Impact.

Citation Range	TP	TP (%)	TC	TC (%)
Uncited	397	26.43	0	0
1-5	566	37.68	1379	9.96
6-10	176	11.72	1403	10.13
11-20	178	11.85	2646	19.10
21-30	76	5.06	1927	13.91
31-40	46	3.06	1588	11.46
41-50	24	1.60	1094	7.90
51-100	29	1.93	1937	13.98
>100	10	0.67	1877	13.55
Total	**1502**	**100**	**13851**	**100**

Table 11: Most Cited Papers.

Paper	DOI	TC	TCpY	NTC
Duhan JS, 2017	10.1016/j.btre.2017.03.002	360	60.00	20.33
Jamdagni P, 2018	10.1016/j.jksus.2016.10.002	302	60.40	26.85
Rattan D, 2013	10.1016/j.infsof.2013.01.008	226	22.60	16.41
Pukazhselvan D, 2012	10.1016/j.nanoen.2012.05.004	168	15.27	13.27
Tomer VK, 2016	10.1039/c5ta08336b	164	23.43	14.73
Saini MK, 2012	10.1016/j.ijepes.2012.04.045	164	14.91	12.95
Chander S, 2015	10.1016/j.egyr.2015.03.004	138	17.25	8.11
Verma P, 2015	10.1016/j.carbon.2015.03.063	134	16.75	7.88
Gupta P, 2017	10.1109/tpwrd.2016.2540723	119	19.83	6.72
Tomer VK, 2016	10.1016/j.snb.2015.09.139	102	14.57	9.16
Total Citations of Highly Cited Papers		**1877**		

DOI =Digital Object Identifier, TCpY = Per Year Citations, NTC = Normalized TC

Figure 2: Thematic Map.

various sources. A total of 1877 citations were received by these ten papers, with an average of per paper 187 cites. The paper authored by Duhan *et al.* (2017), *"Nanotechnology: The new perspective in precision agriculture"*, received 360 citations and was published in *Biotechnology Reports*.

Thematic map of DCRUST's Publications

Figure 2 visualises four themes of centrality and density with a thematic map. One hundred words were selected to draw the plot, five times least occurrence and 3 cluster levels.

1. *The motor theme is x-ray diffraction*, shown in cluster 2. This cluster is represented by 24 keywords: x-ray diffraction, nanoparticles, high-resolution transmission electron, microscopy, particle size, synthesis, transmission, etc.
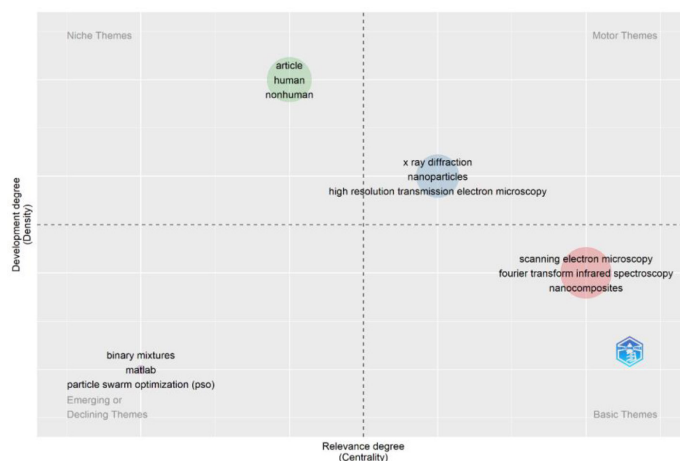
2. *The basic theme is scanning electron microscopy*, represented by cluster 1. This cluster consists of 26 words (scanning electron microscopy, fourier transform, nanocomposites, energy gap, temperature, adsorption, glass, zinc oxide, silica, etc.

3. *The niche theme is article human nonhuman* placed in cluster 3. This cluster involves 30 keywords (article, human, nonhuman, controlled study, chemistry, humans, unclassified drug, female, carbon, India, electroencephalography, procedures, etc.

4. *The emerging or declining theme is binary mixtures* exemplified by cluster 4 and composed of 20 keywords (binary mixtures, artificial intelligence, matlab, particle swarm optimization, optimization, signal processing, power quality, finite element method etc.

Mapping of Keyword Co-occurrence

Figure 3 shows the map of the most frequent keywords. Therefore, out of 11914 keywords, 200 were selected to draw the visualisation graph. These keywords are categorised and visualised in eight clusters.

The 1st cluster comprises 66 keywords (activation energy, barium compounds, bismuth, bismuth compounds, chemical coprecipitation methods, cobalt, combustion, crystal structure, crystallite size, dielectric losses etc.) The second cluster includes 37 keywords (adult, animal, animals, article, biosensing techniques, biosensors, carbon nanotube, chemistry, controlled study etc.) The third cluster comprises 32 keywords (adsorption, antibacterial activity, anti-infective agent, aromatic compounds, bacteria, biodegradation, carbon, carbon nanotubes, cellulose, chemical analysis etc.) The 4th cluster represents 20 keywords (algorithms, artificial intelligence, biomedical signal processing, diagnosis, diseases, electroencephalography, energy efficiency, feature extraction, fuzzy logic, genetic algorithm etc.) The 5th
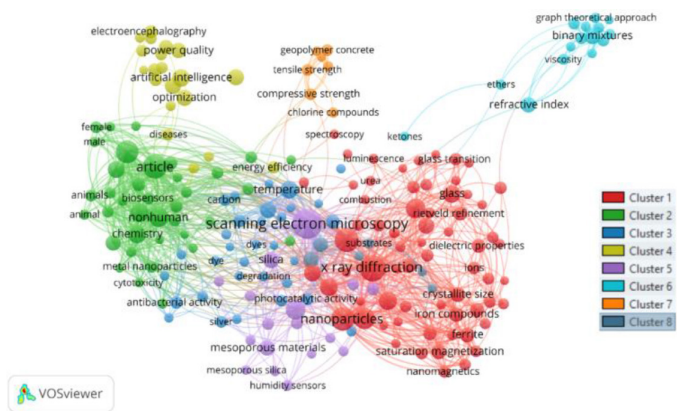
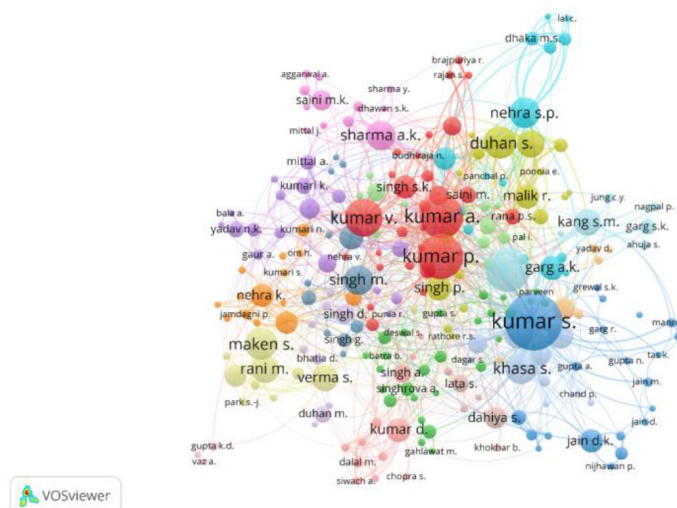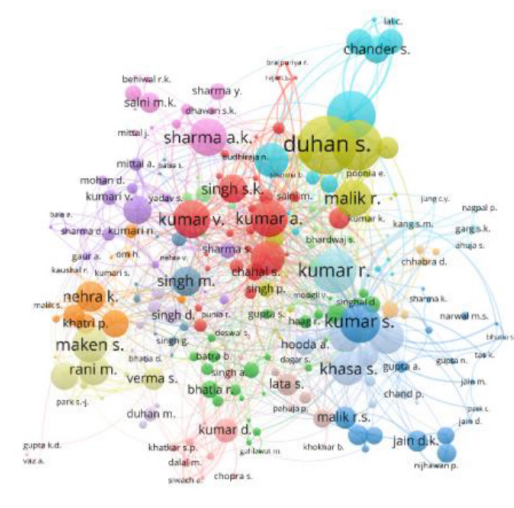**Figure 3:** Co-occurrence Network Map of Author's Keywords.

Figure 5: Author Collaboration (Citations).

CONCLUSION

The present study uncovers the research impact and publication growth of the Deenbandhu Chhotu Ram University of Science and Technology as seen through the Scopus database from 2011 to 2021. During the study period, various countries' authors have jointly published their articles with DCRUST. It was observed that the three author–publication pattern was most favoured, and there was a small number of single-authored publications. In 2021, the maximum number of publications was recorded at 256 (17.04%), followed by 248 (16.51%) publications in 2017. The study found that the maximum number of documents published were in the form of 1003 (66.77%) article followed by conference papers 361 (24.03%). Sanjeev Maken, Sanjay Kumar and Satish Khasa were the most prolific authors. *AIP Conference Proceedings* and the *Journal of Molecular Liquids* were the most preferred sources during the study period. DCRUST has a strong collaboration with Maharshi Dayanand University (139 publications) at the domestic level and globally with South Korea (84 publications). It should suggest that well-known journals should be preferred to publish research to get a broad impact. This analysis provides a satisfactory sign of the research activities and research pattern. The university should make more effort to develop a professional research environment and pay more additional attention to multidisciplinary research.

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CONFLICT OF INTEREST

The author declares that there is no conflict of interest.

Figure 4: Author Collaboration (Publications).

cluster consists of 17 keywords (atmospheric humidity, field emission microscopes scanning, electron microscopy, humidity sensors, hydrothermal etc.) The 6th cluster consists of 15 keywords (binary mixtures, ethers, excess molar volume, graph theoretical approach, graph-theory, intermolecular interactions, ketones etc.) The 7th cluster consists of 7 keywords (chlorine compounds, compressive strength, fly ash, geopolymer concrete, geopolymers, tensile strength). The 8th cluster consists of 6 keywords (annealing, ii-vi semiconductors, substrates, thin films, zinc oxide, zinc sulfide).

Author Collaboration Map

Figure 4 shows the author "Kumar S" got the highest rank in research collaboration regarding publication (138) with total link strength (298), and in Figure 5, one can see that "Duhan S" got the highest citations (1643) with total link strength (178). "Kumar P" (96), "Kumar R" (93), and "Kumar A" (91) have research collaborations with 932, 707, and 1060 citations, respectively.

ABBREVIATIONS

DCRUST: Deenbandhu Chhotu Ram University of Science and Technology; **HEI:** Higher education institutions; **TP:** Total number of publications; **WSC:** Without self-citation; **TC:** Total number of citations; **ACPP:** Average citations per paper; **RGR:** Relative growth rate; **Td:** Doubling time; **AC100:** Papers having at least hundred citations or more; **SJR:** SCImago Journal Rank; **NTC:** Normalised citations.

REFERENCES

1. Chaturbhuj SB, Motewar NR. Scientometric analysis of the research productivity of Savitribai Phule Pune University. DESIDOC Jl Lib Info Technol. 2021 Nov 1; 41(6):438-47. doi: 10.14429/djlit.41.6.16993.

2. Deenbandhu Chhotu Ram University of Science and Technology internet. Wikimedia Foundation; 2022. Wikipedia. Wikipedia cited 9/5/2022. Available from: https://en.wikipedia.org/wiki/Deenbandhu_Chhotu_Ram_University_of_Science_and_Technology.

3. Siwach AK, Parmar S. Research contributions of CCS Haryana Agricultural University, Hisar: A bibliometric analysis. DESIDOC J Libr Inf Technol. 2018 Sep 1;38(5):334-41. doi: 10.14429/djlit.38.5.13188.

4. Lakshman D, Devi M. Analyzing the funding and personal acknowledgements of the publications of the University of Kerala during 2001-2018. Ann Libr Inf Stud (ALIS). 2020;67(3):148-55.

5. Keshava SPL, Mamatha V, Shanthakumari K. Scientometric analysis of publication output of Tumkur University faculty: A study based on Scopus database. Journal of Indian Library Association. 2021;56(4):16-28.

6. R SK, K K, S L. Scientometric Profile of the University of Madras, The Mother of South Indian Universities. DESIDOC Jl Lib Info Technol. 2020;40(3):185-91. doi: 10.14429/djlit.40.03.14844.

7. Singh I, Singh P, Rawat P, Patel AK, Singh M, Singh K, *et al.* Research productivity of Forest Research Institute, Dehradun during 1990-2019: A scientometric approach. Indian Forester. 2021;147(8):767-77. doi: 10.36808/if/2021/v147i8/164678.

8. Kappi M, M. CS, Biradar BS. Measuring Research Productivity of Universities with Centre with Potential for Excellence in Particular Area (CPEPA) status in Karnataka State. DESIDOC Jl Lib Info Technol;41(5):358-67. doi: 10.14429/djlit.41.5.16507.

9. Mondal D, Chakrabarti B. Assessing the research performances of Indian institutes of science education and research (IISERs): A scientometric exploration of 15 years contribution. Library Herald. Library Herald. 2021;59(3):226-44. doi: 10.5958/0976-2469.2021.00034.8.

10. Pandya MY, Joorel JS, Solanki H. Research productivity of newly established central universities in India. Ann Libr Inf Stud. 2021;68:67-74.

11. Shettar IM, Hadagali GS. Collaboration pattern in the research output of National Institutes of Technology in India during 1999-2018. Journal of Indian Library Association. 2021;57(2):108-22.

12. Mukherjee B, Singh A. How collaborative is Indian academia? A case study of top three ranked institutions. Ann Libr Inf Stud. 2022;69(1):66-74.

13. Scopus – document search internet; 2022. Available from: scopus.com cited 9/5/2022. Available from: https://www.scopus.com/search/form.uri?display=basic&zone=header&origin=searchbasic#basic.

14. Aria M, Cuccurullo C. Bibliometrix: An R-tool for comprehensive science mapping analysis. Journal of Informetrics. 2017;11(4):959-75. doi: 10.1016/j.joi.2017.08.007.

15. Subramanyam K. Bibliometric studies of research collaboration: A review. J Inf Sci. 1983;6(1):33-8. doi: 10.1177/016555158300600105.

16. Lawani SM. Quality, collaboration, and citations in cancer research: A bibliometric study PhD thesis. FL: Florida State University; 1980.

17. Ajiferuke I, Burell Q, Tague J. Collaborative coefficient: A single measure of the degree of collaboration in research. Scientometrics. 1988;14(5-6):421-33. doi: 10.1007/BF02017100.